MAY 25 1925

May 21, 1925

Engineering News-Record

Devoted to Civil Engineering and Contracting
McGraw-Hill Company, Inc.

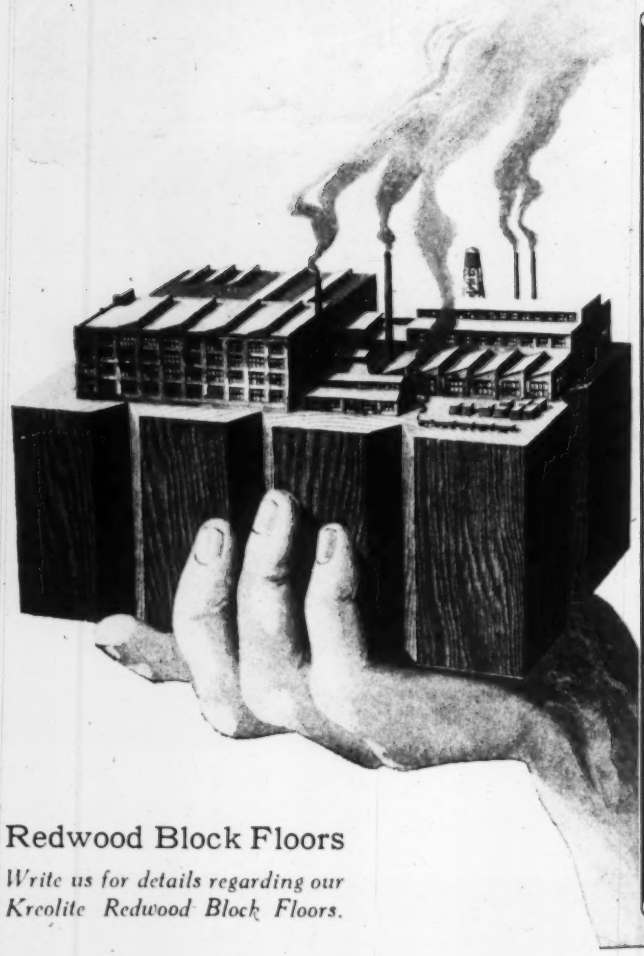
Philadelphia Builds Broad Street Subway—The Tribune Tower Building, Chicago—Cantilever Floor Construction for Concrete Building—Outstanding Practice Problems of the Profession

Reviews of Recent Books on Engineering Subjects

Starting the Cut and Cover Work on Philadelphia's New Subway

KREOLITE

Outlast the Factory



Redwood Block Floors

Write us for details regarding our Kreolite Redwood Block Floors.

Big Business is Built On Kreolite Floors

As the *soil* is the producing part of a farm, so the *floor* is the producing surface of every factory.

Kreolite Floors are laid with the tough end grain uppermost. Once down, your flooring problems are *permanently at an end.*

These blocks, protected from decay and wear, are the foundation of successful production in *all* lines of business; machine shops, foundries, warehouses, paper mills, tanneries, roundhouses, stables, etc.

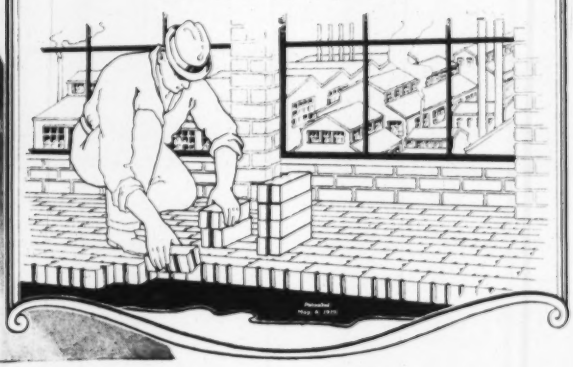
Groaning loads simply compress the wood fibre, making the blocks *tougher* and *stronger.*

Through the Patented Grooves, the Kreolite Filler binds the blocks together into a unit of strength, making a floor that is warm, resilient and easy on workmen's feet. Wear—tear—heat—cold—moisture—acids—no matter what the need in *your* factory, Kreolite Floors *meet* it.

You can resurface old or worn floors with Kreolite Blocks without interfering with production.

Let our Kreolite factory engineers study your factory floor needs, *gratis.* Write for booklet.

The Jennison-Wright Company, Toledo, Ohio
Branches in All Large Cities



FLOORS

WOOD BLOCK

A Consolidation of Engineering News, Engineering Record and The Contractor

ENGINEERING NEWS-RECORD

McGraw-Hill Company, Inc.
JAMES H. McGRAW, *President*
E. J. MEHREN, *Vice-President*

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

Volume 94 NEW YORK, MAY 21, 1925 Number 21

Light Still to Come

NOTHING has been learned concerning the Mississippi River tragedy, in the week since it occurred. Some details of the human side of the picture are filled in by the information given by Mr. DeBerard on page 858 of this issue, but no approach is yet made toward an explanation of the "Norman's" capsizing. Nothing can be salvaged from the wreck except knowledge of the defect or mischance responsible for the accident. That one slight bit of gain we must have. It will contribute another infinitesimal mite to the long list of dearly-bought lessons that have been accumulating for long generations, to ward off needless disaster.

Low Road Bids Again

WARNING is sounded by the superintendent of public works of New York that road contractors are bidding "too low to do a profitable business." From far-off Nevada the highway department announces that early bidding this year "was well below the engineer's estimates." Special correspondence from Indianapolis tells us that in Indiana so far "bids have been materially lower than estimates." In brief it appears that the road contractor, running true to form, again this year is angling to hook a job and not to net a profit.

A Wise Decision

ENGINEERING Council has been well advised in refusing to go along with the architects who insisted that the engineers' campaign for a Department of Public Works should urge an assistant secretary of the interior for architecture as well as one for public works and public domain. The contractors made an absurd issue of the architects' claim, when they in their turn said that if a special department of architecture were to be considered they wanted one on construction. So Engineering Council was put in the unhappy position of asking Congress to provide a Department of Public Works with three separate sub-divisions as interlocking in their fields as a can of worms. Such a department simply could not have been accepted by Congress, as the Council has fortunately decided. The architects will have to carry on their fight alone. If they are wise they will fall into line in an advocacy of two sub-departments, one on public domain and one on public works, and hope that some day possibly an architect may head the latter.

Steam Shovels Dig Subways

RAPID transit subway construction ordinarily offers few opportunities for bulk excavation using large excavator units. In busy city streets, which are the normal routes for subways, heavy buildings closely border the excavation and the street under-surface is traversed by service conduits of many kinds and often of uncertain location. Protecting of these structures is the first requirement of subway building and it can be provided ordinarily only by piecemeal removal of the earth and rock. Quantity production is obtained by operating at numerous points. In the Philadelphia subway construction, described in this issue, one of the contractors is following the traditional methods proved by long experience. Another has departed from all precedent by proceeding much in the same manner and with much the same tools that would be employed for wide and deep trenching in the open fields. He has been able to do this, let it be noticed, because the wide city boulevard in which he is working offers scarcely greater hindrances of bordering buildings and under-street conduits than does a cut in the open. About the only complication due to city location is that the cut has to be covered. The design of open bracing by which this has been accomplished without hampering the steam shovel operation is the notable feature. Steam shovels have been used before in subway construction but for short and special operations. As a general subway construction method their use as described on the Broad Street work in Philadelphia is new. They are a bold innovation whose economic success will be watched with interest.

How Much Is It Worth?

HOW far should choice of water meters be confined to those of a single make and type is a question that arises from time to time. A few months ago a New Jersey community advertised for a supply of meters and specified the trade name, thus cutting out all competition. Now comes a large western city with open specifications, but with an award at a dollar a meter above the lowest bidder. In each case the reason given for the action was a desire to continue a make already in use. How much extra capital outlay is it worth while for a city or company to make in order to simplify maintenance and repairs by confining its meters to one make?

A Rough Road

AT ITS coming convention in Orlando, Fla., the American Association of Engineers is likely to have a rather agitated time. During some months past it has been troubled with interior ailments, which as they developed could be seen to be increasingly serious. For a time it seemed that the ills were minor, and could be treated by readymade cures. However, the troubles are organizational and as is usually the case their underlying causes are of fundamental character. The present situation, in fact, is similar to but even more critical than that of two years ago, when the Norfolk convention was concerned with antagonisms so bitter as to threaten destruction of the association. Personalities have changed, but the differences of view are quite as sharp. Looking back over the whole history of the

association one is impressed with the difficulties that beset its endeavor to weld the profession together. If engineers are to unite in harmonious action, they must be able to meet on common ground, understand each other and reach agreement; yet often they show an aptitude in the very opposite direction, and the essential meaning of harmony and unity in professional life is more often denied than recognized. This condition is not peculiar to the American Association of Engineers, but is reflected by many engineering bodies in the primitive character of their local activities. Doubtless it is an ephemeral condition, one that will disappear as the profession develops more fully; for the time being, however, it is a real and formidable difficulty, and it makes the road to professional unity and co-operation a long and hard one.

Need for Scientific Adventuring

BEFORE a convention of electrical men at Houston a week or so ago General Guy Tripp of the Westinghouse Company emphasized, and illustrated by unfamiliar reference, a familiar but none-the-less valid criticism of a prospective government ownership of electric power systems. General Tripp called attention to the much greater development of the utilization of electricity in this country than abroad. This is not, he said, because of the inferiority of the scientific mind, for Europe has produced, and is perhaps still producing, more great scientists than the United States. It is much more likely that it is due to the great superiority of private initiative over governmental ownership and control in pioneer development. Whether or not an established public business, like the post office, thrives better under government direction is a different matter; there are arguments which may be made on that side. But electrical development is in its infancy and needs the chance-taking promotion of private capital. General Tripp indicated just a few of the things that may lie ahead—the further extension of the wonders of radio, the possibility of converting into light more than the 5 per cent of force that goes into the incandescent bulb, the wasted 84 per cent of heat between the coal and the best known turbine, the latent power of the wind and the wave. All of these great things lie ahead of us, to be discovered by science, but to be developed more quickly by the adventuring spirit of business than by the sober and conservative direction of government. The inevitable deadening of this adventuring spirit under government control is the greatest menace its possible extension offers.

A Cumbersome Method

THE rapid spread of the formation of sewerage or water districts embracing a number of municipalities makes it pertinent to sound a warning against adopting the cumbersome plan which hampers the operation of the Passaic Valley Sewerage District in New Jersey. Under this plan, dictated to meet constitutional and political conditions, the various municipalities contract (1) with each other and (2) with the respective commissions for the construction of joint schemes of sewerage and water supply, respectively. Consequently, when an additional community wishes to join either district, or when for any other reasons a change is proposed in the holdings of the proprietary shares in the joint obligation and services, it is necessary to get each municipality to agree separately to a modification of the contract as it stands at the time. Just now, the City of Orange, after 15 or 20 years of local indecision and change, wants to enter the Passaic Valley Sewerage District. The commission is willing; so are 14 of the 15 municipalities in the district; but the fifteenth, Garfield, with a population of about 20,000 in 1920, will not consent, and there the matter stands. The water district, after years of negotiation, is still in a sense unformed, or consists as yet of Newark only as a municipality with completed contractual relations with the water commission. Again and again, the joint contract has been ready or almost ready to sign when some one community thought to be committed to join has decided to keep out, or wanted a new allocation of water; or else additional communities applied for admission, necessitating further postponements and conferences. All or much of this could be avoided by a simpler mode of procedure, under which the commissions would contract with each municipality separately, instead of with all jointly. Constitutional limitations were thought to have barred this but no attempt to get them removed has been made. Communities in other states will do well to beware of the New Jersey sanitary district plan.

Irrigation Failures and Successes

THERE is no end to the maze of contradictions and puzzling facts that Western irrigation can present. That some projects succeed, while others fail, that the low grain prices of the last few years have produced extensive hardship among the farmers, that the landholders on the government reclamation projects protest their inability to pay their obligations, while at the same time their neighbors clamor for additional government irrigation at even greater cost per acre—these things are known, though not altogether understood. But the frequent evidences brought forward tending to show that private irrigation enterprises can succeed under conditions far more severe than those of any government enterprises are nevertheless perplexing.

Quite recently a farmer on an irrigation enterprise in southern Washington stated that his project "meets obligations equivalent to that of a government project costing $150 an acre, on the present scale of repayment." Not all the farmers are able to make out, he admitted, but nevertheless they are given support and assistance by the directors of the enterprise until it is proved that they cannot succeed. When it is finally determined that they cannot pay their obligations, they are foreclosed. Doubtless, this selective process, by weeding out the wheat, establishes the condition that makes the project a success. Another project, recently described at some length in a Western journal, pays annual charges of $15 to $17 an acre, or several times as much as the highest charges assessed on government projects (but on most of them not paid).

Facts such as these seem to point very forcibly to some fundamental difference between private and government irrigation. Does it lie in the fact that the government has loaned its money to the settlers without interest? Or in the action of successive Secretaries of the Interior who have deliberately omitted to defend the government title to the irrigated lands when the landlords declined to pay the due installments of their

charges? Whatever be the explanation, the facts as they stand today appear to show that no government project costing over $50 an acre for irrigation work can pay its charges; that private enterprises two or three times as costly can succeed; and that nevertheless, the Western States continually ask for more government money to build irrigation works—even at costs so alarmingly high as to make it sure beyond all doubt that they can never pay their costs. These are contradictions indeed. From among them one fact appears to emerge, namely, that private and state enterprise are able to accomplish all that is expected of government financed reclamation and that they can avoid every one of the bitternesses and hardships that have, rightly or wrongly, been attributed to government reclamation.

To Temper the Competitive Urge

"WHATSOEVER things are true" wrote Paul to his friends the Philippians, "whatsoever things are honest, whatsoever things are just, whatsoever things are pure, whatsoever things are lovely, whatsoever things are of good report . . . think on these things." This centuries old basis of conduct still holds good; these are the essentials of any code of ethics. The trouble in formulating such a code is in determining exactly what is true, and honest, and lovely, and just and pure and of good report. Moralists and philosophers and priests have not been too successful in the ages they have been trying to define these terms; no wonder the professions are still somewhat hazy in their definition. And less wonder still that the very young profession of engineering is not only groping for terms but has difficulty in maintaining adherence to such terms as are ostensibly agreed upon.

For it must be admitted that the professional ethics of engineering are neither satisfactorily formulated nor universally followed. There are, to be sure, certain adopted codes, made up of fine words which no one can controvert but of such embracing vagueness that interpretation is a matter of individual desire. And this desire runs such a gamut that that which is to one man anathema becomes to another an acceptable and accepted practice. Certain things are permissible, certain other things lie beyond the pale. In between is territory where the engineer may roam at will. There is no Supreme Court which interprets the law and publicly enforces it.

Every effort to delimit the law or to expound it is commendable. Lacking as a profession does any precise codifying body with enforcement power, the process of ethical development must be through consensus of its members. In time, with the development of professional consciousness there may come some measure of disciplinary control but the way toward that control lies in just such action as D. B. Steinman has undertaken for the American Association of Engineers, and which is reported in essence in his article in this issue. Permissible professional conduct will become more and more precisely defined as the leaders of the profession attempt to interpret specifically the broad principles on which they are all agreed. Ways of enforcing observance of such rules of conduct must wait on their definition.

No rule or code can give engineering skill to a man who does not have it, nor make an engineer exercise all the care of which he is capable. Engineers as a group can not presume to grade individuals in technical standing. But it is not unreasonable to hope that the group can temper the competitive urge. It is significant that all discussions of a code of conduct for engineers revolve around this question of competition for business. It is assumed that once he has been employed the engineer will give the best that is in him, that he will design soundly and build truly, that he will make no concessions to expediency or personal gain. For after all these are the things which are true and just and of good report. Codes and laws will not alone produce them or foster them, unless something comparable in solemnity to the doctor's Hippocratic oath can be developed for engineers. The common honor of the profession must insure observance of such fundamentals. But to practice a profession one must have something to practice on, and in the seeking for that something there arises that strong drive of competition which, since engineers are but men with the urge to live and to make a living, lets loose the self-preservative instincts.

It may be a pleasant mental exercise to set up an ideal state of society where engineers become individually so expert and so well known that commissions come to all of them unsought. In the real world conditions are different. In plain words there are more practising engineers, acting as principals, than there are jobs. There is the constant struggle for the majority of those principals to get enough of the existing work to maintain themselves as principals and to keep from falling back into the ranks of the employed, ranks that are apparently not so crowded as are the upper strata of the employing class. Work, too, must be sought to a large extent not from old clients, as is the case with the doctor and the lawyer, but from new interests who too frequently know nothing about engineers or engineering. Competition becomes a dominant factor in independent engineering, and the selfish motive strong in those who are trying to practice it.

The problem of the code, therefore, is to set up an altruistic motive that will reinforce and justify the selfish one. It is not enough merely to assume that everybody agrees that certain things are not to be done; reasons must be given why they are not to be done. Because such reasons generally go back to the underlying necessities for truth and justice and honor, they lack force, for generalities on ethical conduct are always subject to individual interpretation. They must, therefore, be put on the more practical ground that self advancement lies also in the advancement of the profession one practices. Possibly this is intangible but it is, nevertheless, real. To insure common agreement as to its reality requires the active force of publicity, just such publicity as is gained by discussions like the one fostered by Mr. Steinman.

Further than that, this publicity must ultimately be extended into the punitive field. So long as haziness as to details exist such attempted punishment will only result in fruitless discussion, and agreed upon punishment would stand a fair chance of being unfair. The time to try cases may not now be ripe but once the principles are well established the profession must enforce these principles and put some teeth in its code of ethics. Until it does observance of the code will remain a matter of individual interpretation.

Philadelphia Builds Broad Street Subway

Seven-Mile Four-Track Line Well Begun—Steam Shovels Load Trucks in Covered Trench—Heavy Timbering for Trench 70 Ft. Wide and 40 Ft. Deep

SUBWAY construction, after several years of marking time, is in rapid progress on the main trunk line on Broad St. of the proposed Philadelphia rapid transit system. Two sections of the Broad St. line, aggregating 18,722 ft., are under construction, contract has been awarded on a third section 7,184 ft. long and about 9,000 ft. remain to be put under contract. This 6¾ miles of subway is four-track railway throughout, and, equipped for operation, it is estimated will cost around a hundred million. The construction plant and methods on the 18,722 ft. being built now are the subject of this article. Both contractors have put in elaborate outfits and one has successfully inaugurated a method of excavation never before employed throughout in subway construction.

Rapid Transit Plan—The Broad St. subway is a part of a system of rapid transit railways laid down by a commission of the City Council on July 24, 1923; approved by a referendum vote of the people Sept. 18, 1923, and financed by a loan bill voted Nov. 6, 1923. The plan supplants previous plans and part plans. Engineering and construction are in charge of the Department of City Transit created in 1913. The plan as adopted is indicated by the map, Fig. 1. In it are to be noted particularly the present Market St. subway with its loop around the City Hall and at this same point the kink in the Broad St. route where it passes under the City Hall and under the Market St. loop.

As laid out for immediate construction by the Department of City Transit, the Broad St. line is shown by Fig. 2. It is virtually a straight line except for the kink under City Hall. Here under a preceding plan a section under the building and its encompassing subway had been completed in 1919. Then a deflection from the axis of Broad St. had been introduced to avoid passing directly under the 550-ft. tower in the north front of the building. The construction operation was notable and will be found described in *Engineering News-Record*, Aug. 14, 1919, p. 300. Fig. 2 indicates the station location and Fig. 3 gives the details of the standard four-track construction. Neither station nor line design and structure vary significantly from familiar practice.

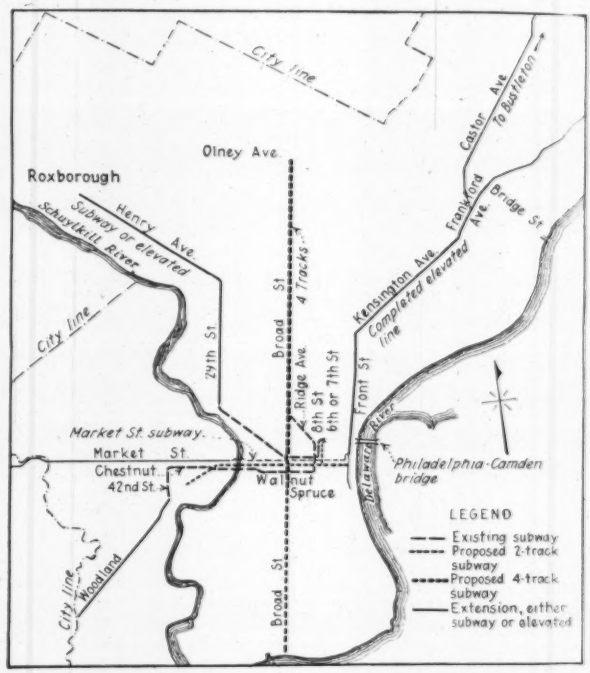


FIG. 1—GENERAL PLAN OF PHILADELPHIA RAPID TRANSIT SYSTEM

System adopted by referendum vote of the people Sept. 18, 1923, and by the loan bill voted Nov. 6, 1923.

General Contract Conditions—Special attention was given to the working plans. They covered every detail

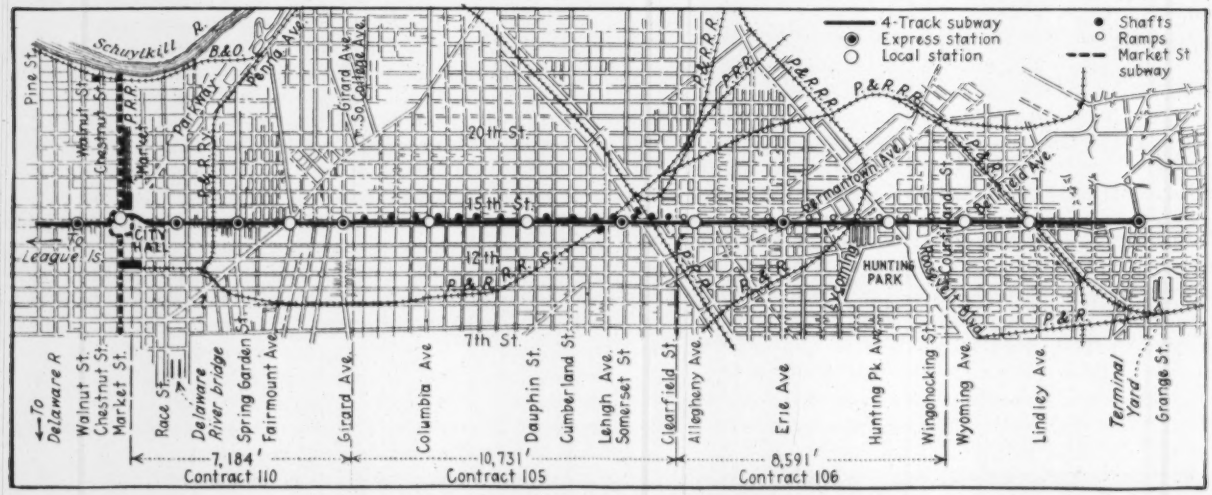


FIG. 2—LINE OF BROAD ST. FOUR-TRACK SUBWAY

Cost of this main four-track artery of Philadelphia's new rapid transit system, with equipment, will approximate $190,000,000

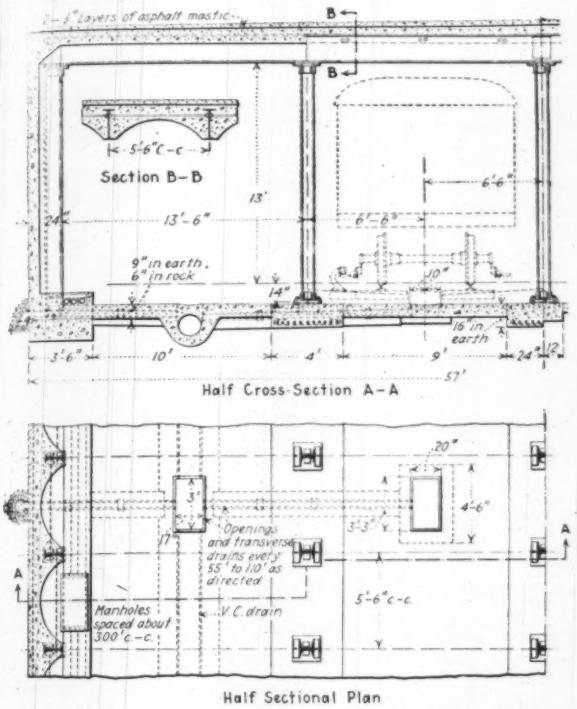


FIG. 3—STANDARD SECTIONS OF FOUR-TRACK SUBWAY STRUCTURE

Common practice in American subway design followed in all general particulars.

and numbered over a hundred for each contract. Unit price bids were required, except in case of special operations as the reconstruction of crossing sewers or underpinning crossing bridges and railways. In such cases a lump-sum bid for the entire operation was made a single item in the schedule of quantities for comparison of bids. In this schedule also there was a final item "For force account, 300,000 dollars expenditure," on which the unit price bid was a percentage rate. This force account item is emphasized because in the case of one contract it proved a cause of confusion in the amount of the certified check and led to court proceedings to arrive at final decision as discussed in *Engineering News-Record*, April 30, 1925, p. 713.

In general the contract requirements were such as are common for major underground operations in city streets. Construction, as has been noted, is well advanced on two contract sections. Contract 105 for a section 10,131 ft. long is held by the Keystone State Construction Co., Philadelphia, Pa., and contract 106 for a section 8,591 ft. long is held by Patrick McGovern, Inc., New York, N. Y. Different construction methods are employed on these two operations which may be designated as the shaft method and the ramp method respectively.

Construction by Shafts—Besides the station and line construction on contract 105 there were three sewer crossings and a bridge and railway crossing to be reconstructed or underpinned. For the line and station construction the method of procedure specified was trench excavation under cover. The contractor elected to open the full street width and cover it virtually from curb to curb and to carry on the underground work by shafts. Substantially their task, then, was to open and hold a trench from 65 to 70 ft. wide and 25 to 40 ft. deep. It was a large problem in timbering.

A standard timbering plan as shown by Fig. 4 was adopted. Removal of the asphalt on concrete pavement and excavation to the depth necessary to put in the platform of plank, stringers and cross-beams was carried on by half a dozen outfits of portable compressors, paving breakers and clay diggers. An outfit is shown by Fig. 5. With the roadway paved over, digging was begun at the shafts and the platform was carried on posts as the excavation was opened up. The timbering was further carried down in about 5-ft. lifts as the trench was deepened. The drawing, Fig. 4, shows the timbering set for a shallow cut; it was merely repeated to go deeper in cut. A notably strong framework is indicated by the drawing and particularly well by the fragment of an interior view in Fig. 7. It has continuous rigid bracing in both directions and all connections are very thoroughly spliced. There is virtually no light timber in the whole frame, even 3x10-in. plank being used for the diagonal swaybraces.

The interior Fig. 7 shows the track construction. This spoil track is 24-in. gage with 20-lb. rails and metal ties. On it the spoil is taken to the shafts by 2-ton storage-battery locomotives and flat cars carrying 36-cu.ft. buckets. A car and locomotive at shaft bottom are shown by Fig. 8. At the shaft the bucket is lifted by derrick and dumped into a head-frame hopper and thence the spoil goes to trucks which run to a railway siding and dump into cars. A shaft head frame is shown by Fig. 6. There were 15 of these spaced 450 ft. to 815 ft. apart, depending on the width and depth of cut, so as to give approximately the same amount of excavation per shaft. The digging of course is carried both ways from each shaft. A shaft outfit

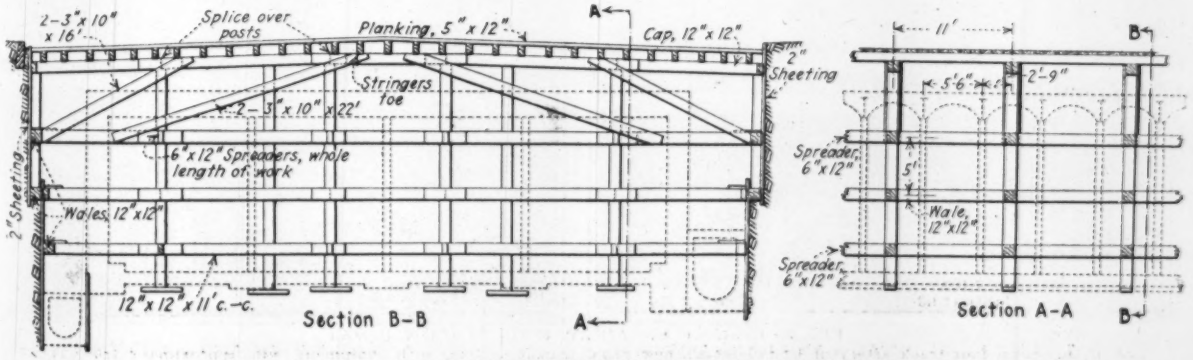


FIG. 4—STANDARD TIMBERING FOR FOUR-TRACK COVERED TRENCH

Excavation opened full width between curbs 66 to 70 ft., and 25 to 40 ft. deep held by system of timbering rigid in both directions.

FIG. 5—COMPRESSED-AIR OUTFIT REMOVING PAVEMENT
Portable compressor and set of pneumatic asphalt cutters, concrete breakers and clay diggers constituted a pavement removal outfit on Contract 105.

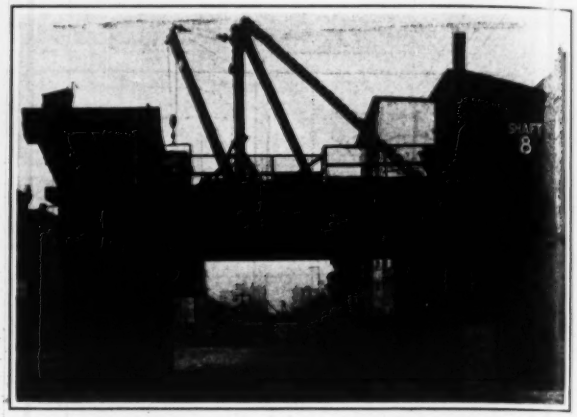


FIG. 6—SHAFT HEAD FRAME ON CONTRACT 105
There were 15 of these shafts placed from 450 to 850 ft. apart along 10,731 ft. contract section. Another shaft head can be seen in the distance

consists of a 40-hp. double-friction electric hoist, a motor generator for charging locomotive storage batteries and 325 ft. of ⅝-in. cable.

Excavation as is common in heavily braced, covered-cut subway work is a series of small operations, the cars being loaded by hand. In rock, hammer drills are used. Generally a center bench cut is taken out and then widened toward the sides, holes and blasts being located and proportioned as the conditions advise. A central plant of four 1,300-cu.ft.-per-minute compressors, two after coolers and one storage tank gives a drill air pressure of 90 lb. at the most distant parts of the work.

In general the construction plan illustrated conforms to familiar practice in open-cut subway work, but the timbering and equipment details have been worked out with more uniformity than usual because of street widths and freedom from subsurface structures. By the plan, with a full-roadway-width trench and excavation in progress all along nearly two miles, the encumbrance of the street surface and hindrance to traffic are negligible. A similar condition exists in the succeeding contract 106 where ramps replace shafts for connection to the surface.

Construction by Ramps—As in case of the Keystone State Construction Co. operation, the specifications for contract 106, 8,591 ft., called for construction by the covered trench method. An original plan, however, was adopted by Patrick McGovern, Inc., for doing the work. The essentials of this plan were: (1) Truss bracing and platform support across the trench, (2) opening and covering half the street width at a time, (3) constructing ramps instead of shafts and (4) loading trucks by steam shovel in the covered trench. All of these methods have been used in places in subway construction but never before have they been combined into a construction method for a complete operation.

In the 8,591 ft. of subway nine ramps were located

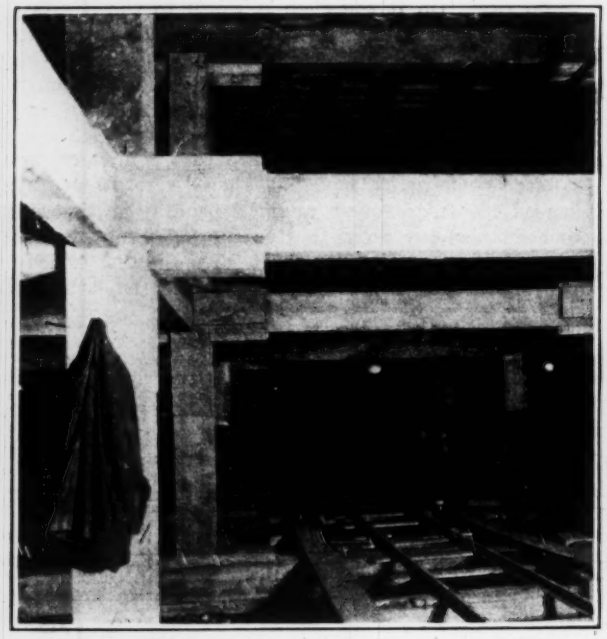


FIG. 7—TIMBERING DETAILS AND SPOIL TRACK
Heavy and well-framed timbering holds full street width trench and carries surface decking. This section is part of Contract 105.

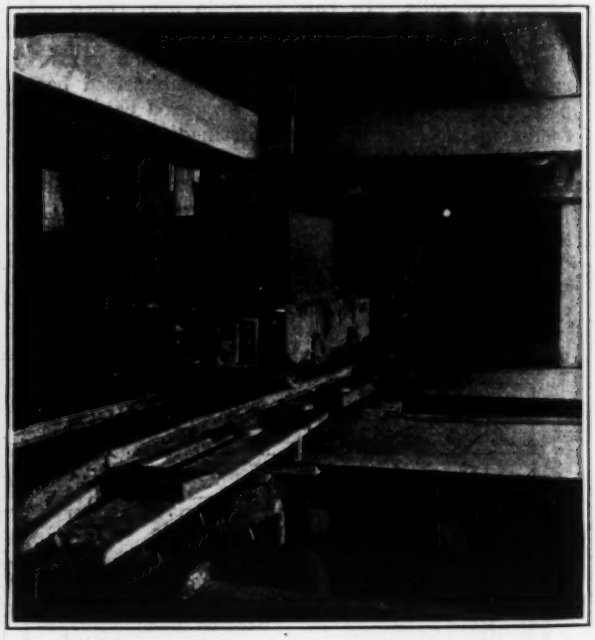


FIG. 8—LOCOMOTIVE AND SPOIL CAR
Storage battery locomotives and 24-in. tracks handled excavation in buckets on flat cars. View shows train at shaft bottom.

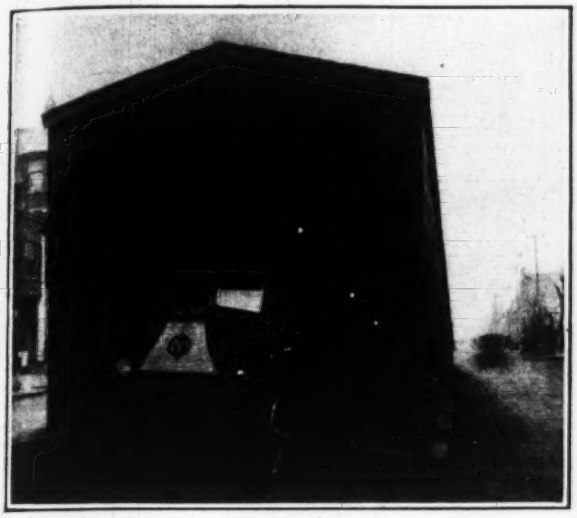


FIG. 9—RAMP ENTRANCE ON CONTRACT 106
Nine of these ramps give truck access to excavation in which steam shovels load the trucks.

at distances apart varying with the depth and width of cut so as to give about the same volume of excavation working both ways from each ramp. The plan in outline is to open and cover half the street width and when this is completed to cover and excavate the other half. The ramp openings were, therefore, located in the middle of the street, as shown by Fig. 9. The ramp construction is shown by Fig. 10. The shortest distance between any two is 500 ft. and the longest is 1,000 ft. It will be observed that the plan contemplated covering and trenching virtually the full length of the section and working simultaneously from all nine ramps.

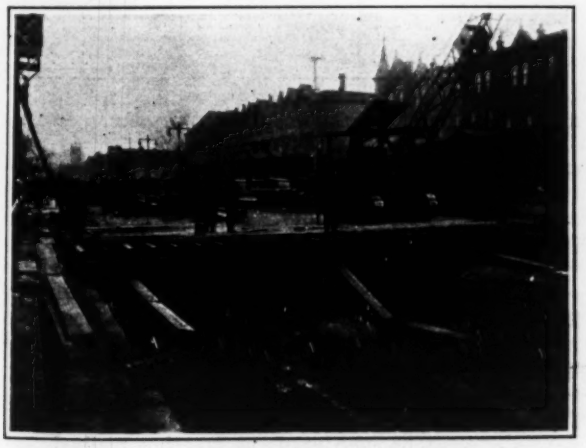


FIG. 11—BUILDING DECK ON CONTRACT 106
First cut made with shovels to depth required for decking on 24-in. I-beam girders.

Construction was begun by taking the pavement from half the street width, making a shallow cut and placing the decking. This operation is shown by Fig. 11. The outfit employed consisted primarily of eight combination machines rigged as shovels, cranes or clamshells as required. They were gasoline operated and usually there were working at one time five as ¾-cu.yd. shovels and two as cranes placing decking. The decking structure is indicated by Fig. 11 and is shown in detail by the timbering plan, Fig. 12.

The notable feature of the timbering as will be seen is that it bridges the trench with a clear span so that construction underneath is unobstructed. Fig. 12 shows the timbering for a deep cut. Where the cut is shallow the members marked *A* are omitted. The clear cut provided by this method is indicated by Fig. 13.

Virtually all excavation is by steam shovels loading directly into motor trucks which climb the ramps to Broad St. and go on their way to the dumps. There are eight shovels in use, all ¾-cu.yd., air-operated, crawler-traction machines. Fig. 13 shows the air hose to the shovel. For compressed air the contractor has two plants. A central plant shown by Fig. 14 contains six 23—13x16-in. compound machines operated by individual motors. The secondary plant consists of two 14x12-in. compressors belt operated by electric motors.

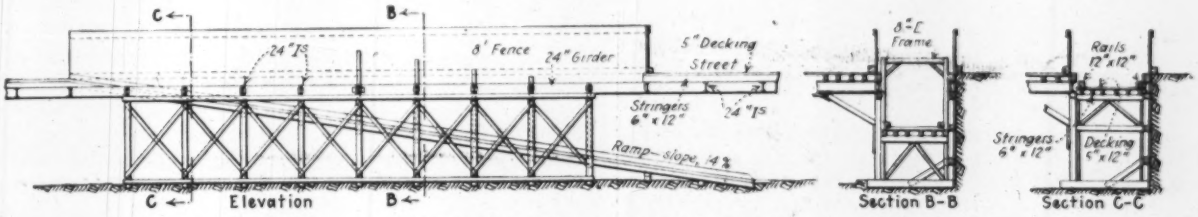


FIG. 10—DETAILS OF RAMP STRUCTURE

These plants furnish all air for drills, steam shovels and minor uses.

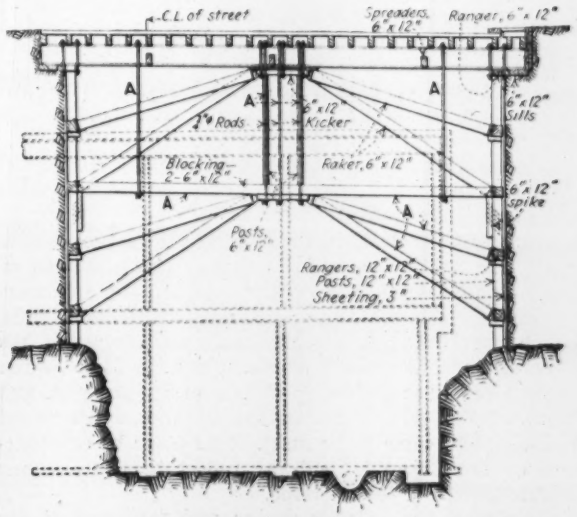


FIG. 12—STANDARD TIMBERING ON CONTRACT 106
Trench half the street width bridged over to leave clear space for operating steam shovel.

Blasting is required the full length of the contract. Owing to the varying character of the rock there can be no regular procedure but generally a center bench

cut is shot out and then widened. If there is no overburden, vertical line holes are used. With an overburden the method will be to use horizontal lifting holes at the bottom of the bench.

Covered open-cut excavation with steam shovel has previously been used only on isolated special sections of subway work, a notable example being the cut alongside the public library on 42nd St., New York City, of the Queensboro subway extension described in *Engineering News-Record*, Feb. 12, 1925, p. 264. The Broad St. work was of course particularly adapted to the steam-shovel method. The street is wide and comparatively free from subsurface structures. There are few building underpinning tasks of great difficulty. The material stands up well.

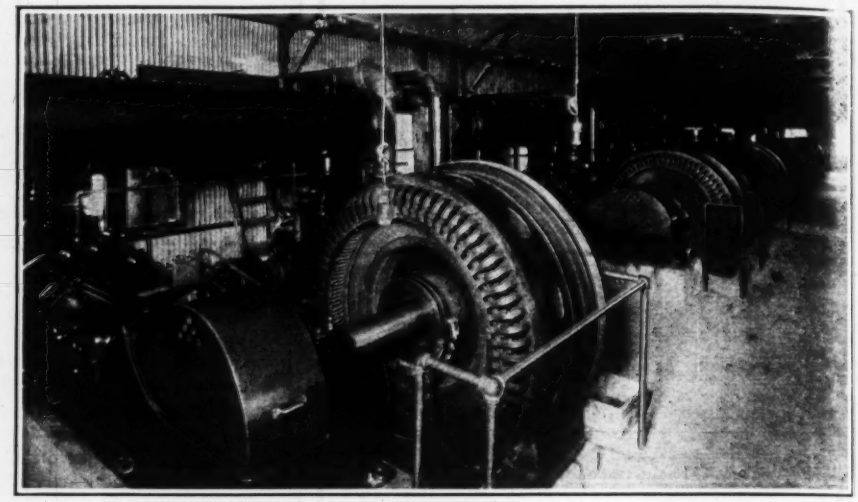


FIG. 14—MOTOR OPERATED COMPRESSORS ON CONTRACT 106
Compressed air operated all steam shovels as well as drills and other tools.

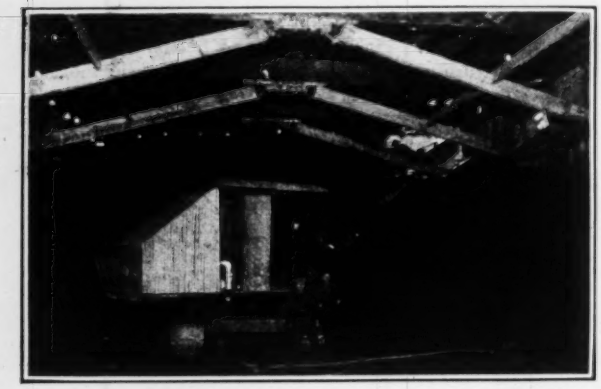


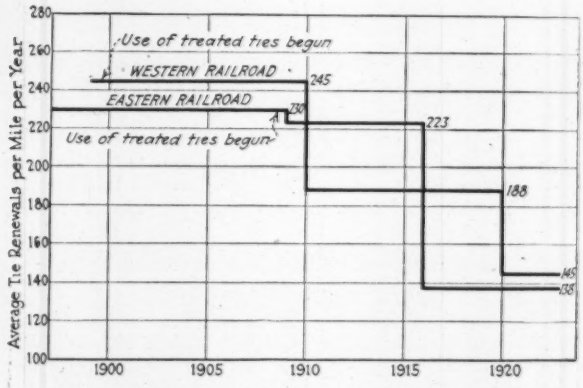
FIG. 13—STEAM SHOVEL WORKING IN CUT ON CONTRACT 106
Eight of these shovels operated by compressed air load directly into motor trucks.

General Construction Characteristics—As contrasted with previous rapid transit underground railway work the Broad St. subway presents a comparatively simple construction problem. On neither of the sections under construction are there the hindrances and hazards of close foundations of old or high buildings or of intersecting and adjacent conduits of several sizes and kinds, which prevail in the streets where subway work has gone on in New York and which will be found when the subway lines shown by Fig. 1, in Chestnut St. and some of the other business-section thoroughfares of Philadelphia, come to be built. The plans of construction on the Broad St. subway reflect these conditions of freedom from obstructions.

As stated, the subway design and construction are under the direction of the Department of City Transit, Henry E. Ehlers, director, Frank R. Fisher, chief engineer, and Charles H. Stevens, engineer of design. The engineers in direct charge of the Broad St. construction are Dion Martinez, James S. Shute and J. L. Dodge. J. S. Macdonald is chief engineer for Patrick McGovern, Inc., and Paul G. Brown managing engineer for the Keystone State Construction Co.

Economy of Treated Ties

Marked reduction in tie renewals due to the use of treated ties is shown by the accompanying diagram issued by the U. S. Forest Products Laboratory, Madison, Wis. The lines, for a western and an eastern railroad, show the reduction in the average number of tie renewals per year after the railroads had begun extensive use of treated ties. Periods of three to twelve years are lumped to equalize the effects of factors other than durability. It is pointed out that in twenty-three years one western railroad has in this way reduced the average tie replacements required yearly per mile of track by an even hundred, without lowering its standard of maintenance. An eastern road has cut its yearly tie requirements 92 to the mile by the use of similar methods, and reports the condition of its roadbed as the best in its history. Still further reduction in the annual tie requirements may yet be effected by both roads as treating methods are improved.



REDUCTION IN TIE RENEWALS BY USE OF TREATED TIES

Cantilever Floor Construction for Concrete Buildings

Column Heads Are Connected Octagonal Cantilever Units—Floorbeams and Wall Columns Eliminated—Form Design

IN A new type of reinforced-concrete building design which has been employed in several industrial structures, residences and other buildings, the floor slab is designed for cantilever instead of beam action, each unit being figured as eight cantilever brackets balanced over one column. In other words, each structural unit is a column with a disk slab, the adjacent disks being either united to form the floor panels or being connected by filler panels which correspond to the suspended span of a cantilever bridge. Fig. 1 is an interior view of this type of construction in the Printcraft Building, Indianapolis; the drawing of this in Fig. 2 shows the cantilevers in contact in one direction and connected by 50-in. panels in the opposite direction.

Each section of the octagonal unit is designed as a cantilever bracket in itself, no allowance being made for the fact that the eight brackets form a monolithic unit and that the several units are joined together as a monolithic floor slab. A material saving in both concrete and steel is said to be effected, as compared with other types of reinforced-concrete construction, while a pleasing interior appearance is given by the tapering cantilever heads of the columns. There being no beam action, holes in the floors for elevators, stairways or other purposes can be formed as desired, without special framing.

A special feature is that no wall columns are required, the end panels being cantilevers which carry the walls; thus the entire exterior area may be composed

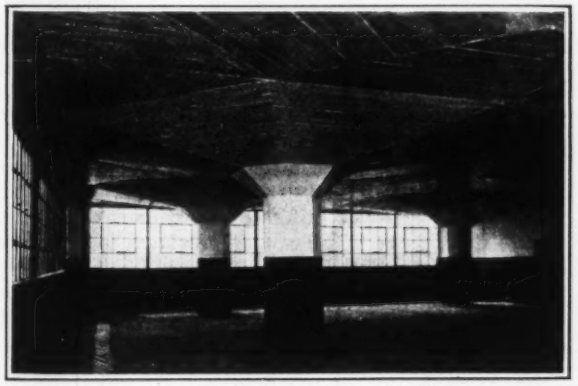


FIG. 1—CANTILEVER FLOORS IN PRINTCRAFT BUILDING

of windows if desired, and there are no columns to obstruct space or light near the wall. Corner columns are provided for the attachment of the sash, but carry no floor loads. In this cantilever design the stresses remain the same, regardless of the application of load, the steel being always in tension and concrete always in compression, with no reversal of stress. The dead-load is fully balanced, and the live-load is also balanced to some extent. All reinforcing is of straight bars, except for spirals and column hoops, so that there is a saving in cost of steel and placing, while the straight bars may permit the use of high-carbon steel of relatively high electric limit, thus effecting an additional saving.

A recent application of this system is in the six-story and basement 55x70-ft. Printcraft Building for

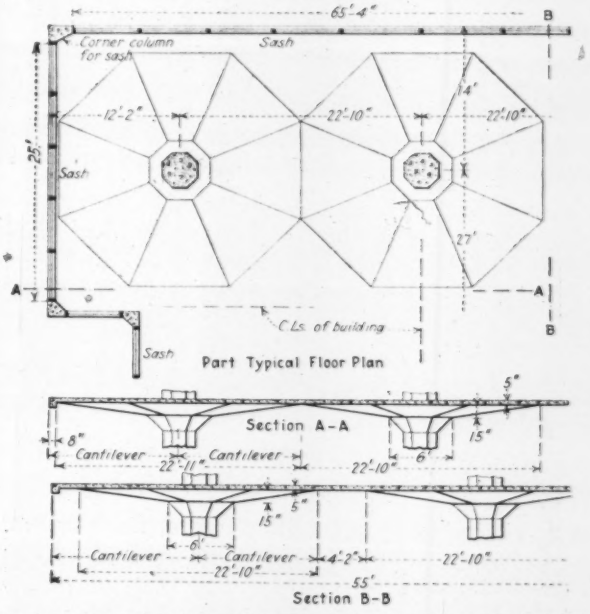


FIG. 2—COLUMNS AND FLOORS FORM CANTILEVER UNITS
Note absence of wall columns except at corners for sash attachment.

the Pauley Printing Co., Indianapolis, where 300-lb. live-loads and an absence of vibration had to be provided for. In this building, shown in Figs. 1 and 2, the floors were designed for six units 22 ft. 10 in. by 27 ft. with the entire load carried on the six interior columns and their footings. The columns are somewhat larger than would be required in other types of construction, but their combined sectional area is said to be less than that of other types. They are of octagonal section, 40-in. diameter in the basement, 38-in. in the first floor, 36-in. to the fourth floor and 24-in. to the roof. From the basement to the third floor the columns were stressed to the allowable 5 per cent with 1 per cent hooping; above this level the hooping is reduced.

A 5-in. slab is used for the floors and 3-in. for the roof, that being the minimum thickness at the ends of the units. All floor reinforcement is placed in the top of the slab, where it will be in tension, the bars being supported on chairs in the forms to insure this position. Floor slabs were finished with steel trowels, a sprinkling of jasperite for hardening being spread over the entire floor before the final troweling. Composition roofing is laid over the roof slab. Each floor was poured continuously, the 1:2:4 concrete being spouted to the forms. Concrete curtain walls are anchored to the edges of the cantilever floor slabs and have a large area of steel sash. The edges of the slabs are formed with caps over the window openings; the spandrel walls and sills were poured after the sash had been set in place.

Standardization of forms is facilitated by this design and the forms, shown in Fig. 3, are erected as large units. In the first place, the column form is set

FIG. 3—ERECTING FORMS FOR CANTILEVER UNITS

up in place; the eight segmental sections are assembled on horses to be bolted together (as at the left in Fig. 3), and this unit is then raised by four small derricks and swung into place around the column form, where it is supported by shores placed under the four sides not held by the derricks. When the form is released, additional shores are placed, and the unit is then plumbed and leveled. No outside bracing is required, each unit being braced within itself. After the filler panels are placed for the spaces between the octagonal units, the floor is ready for placing the steel and pouring the concrete. Where an opening is required, a box or bulkhead is built on the floor form and if the bars have not been cut to length they are pushed back clear of the box. These sectional forms are built of wood, but it is proposed to make them of steel.

In all floors the unit base of the form is the same, regardless of load, any difference in floor strength being

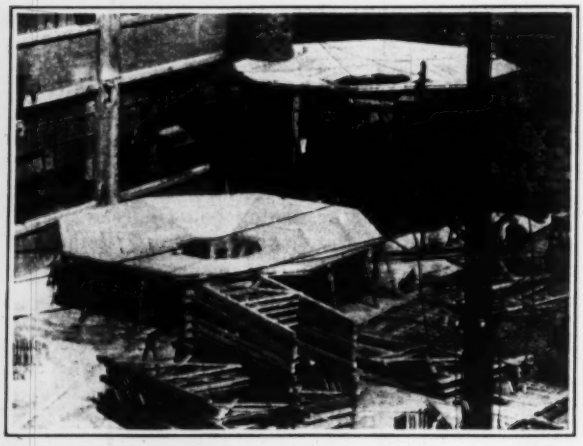


FIG. 4—CLOSE-UP VIEW OF CANTILEVER UNIT FORM

made up in the thickness of slab and amount of reinforcing steel. In a test of strength, a roof designed for 30-lb. live-load was loaded to 145 lb. per sq.ft., the loading beginning at one end and being done in thirty hours. Readings taken after another 30-hour period showed a deflection of only ¾ in. in a 20-ft. span, which was reduced 73 per cent when the load was removed. No injury was done to the roof, which consisted of three bays, the center being a monitor and the load applied on one of the side bays.

Residence Construction—In addition to several industrial buildings this system has been used for a three-story residence 30x40 ft. in which the floors and roof are carried by a single central column. It is adaptable also to other structures of various kinds. Alternative roof designs to meet different requirements in a building 75 ft. wide include two 36-ft. or three 24-ft. units carrying a continuous flat slab, two 30-ft. units with a 12-ft. monitor or saw-tooth skylight seated on the inner cantilever ends, and three 18-ft. units with two 9-ft. monitors or saw-tooth skylights.

This type of reinforced-concrete building construction, known as the "unit-slab" type, was invented and patented by C. B. Foster, of the Foster Engineering Service Co., Indianapolis, Ind.

The New Charter for Westchester County

SUBJECT to approval by popular vote in November, a new form of government for Westchester County, N. Y., will go into effect Jan. 1, 1928, in accordance with a legislative act based on a charter drawn by a special commission. The existing board of supervisors of 46 members made up of town and city representatives, will be continued, but all administrative powers will be vested in three elective officers—a president, vice-president and commissioner of finance—serving four years. The president, or in his absence the vice-president, is the chief executive officer, and appoints the department heads named below (except finance commissioner). He shares certain administrative duties with a board of estimate and apportionment, and still others with a board of contract and supplies, the other two members of each board being the vice-president and commissioner of finance. The president may also veto ordinances passed by the supervisors, but subject to re-passage by a two-thirds vote. The salary of the president is $15,000, of the vice-president, $7,500, and of the commissioner of finance, $12,000 a year. Other salaries are fixed by the board of estimate and cannot be changed by the supervisors. The county president is removable by the governor of the state.

Eight county departments, each headed by a commissioner, are provided for: Finance, contract and supply, health, welfare, law, public works and buildings (really county buildings and their grounds), engineering, weights and measures. These heads, except the commissioner of finance, are appointed and may be removed by the county president; they appoint their deputies and assistants.

The board of estimate is empowered to "investigate the desirability and practicability of the construction, maintenance and operation of a county system of highways, of sewers, of water-works or of any other work or improvement and to frame the necessary enabling legislation to make its conclusions effective." The board is also authorized to investigate the desirability of a county zoning and planning system, a county bureau of information and statistics and other matters of county interest, make reports on any of these—and file the reports with the county clerk.

California Court Decides County May Engage Bridge Engineer

A DECISION just rendered by the California Court of Appeals, Third District, establishes the right of a county board of supervisors to engage a bridge engineer to design and supervise the construction of bridges. The case arose two years ago in connection with the engagement by the supervisors of Sutter County of E. L. Cope as engineer for a bridge over Feather River. This engagement was made by formal contract, authorized by the board. In accordance with the contract the engineer prepared plans and specifications. His bill for this part of the work, submitted in accordance with the terms of the contract, was approved by the board for payment, but the county auditor refused to pay. The litigation followed as a means of enforcing payment. In the original trial, the Superior Court of Sutter County decided in favor of the auditor. The appellate decision reverses this finding and holds the engineer entitled to payment.

The Sutter County Court had said in its opinion:

I believe the statutes setting forth the duties of the county surveyor are broad enough to include such services as work performed by Cope under the contract mentioned. If a county surveyor is required to perform no services other than surveying and laying out roads, he is a useless and expensive appendage. Section 4017 Pol. Code contemplates that he is able and that it is his duty to build bridges whenever it appears that the bids are too high. . . .

The law governing the building of bridges . . . is set forth in Sub 7 of Section 4041 Pol. Code, and this law must be followed by boards of supervisors in the erection of these structures. The contract made by the old board of supervisors precludes the present board from following this law in case the emergency should arise contemplated by the section without great loss to the county.

The compensation fixed for Cope under the contract is not segregated, no amount is designated as compensation for drawing the plans, etc. . . . I think that the board of supervisors had no right either to contract to pay for services that may never be rendered or to tie the hands of the new board in such a manner that they could not have the bridge built under the supervision of the county surveyor without loss to the county. They should follow the statute and first procure plans and specifications as a separate and distinct matter. Then advertise for bids and let the contract to the lowest responsible bidder in case the lowest bid is for a sum less than the county surveyor thinks he can build it for.

In the decision of the Court of Appeals the question of the power of the supervisors to retain an outside engineer to design and direct bridge work is characterized as the basic factor of the case. The decision says:

The vital question in this case really is, Did the board of supervisors have power to employ anyone other than the county surveyor to prepare plans, specifications, drawings, etc., for the construction of the contemplated bridge, and also provide for the erection thereof under the superintendence of the construction engineer so employed? Section 4041 of the Political Code, so far as it applies to this case, and as governing the powers of the board of supervisors, reads as follows:

"The Board of Supervisors, in their respective counties shall have jurisdiction and power, under such limitations and restrictions as are prescribed by law:

"5. To lay out, maintain, control, construct, repair and manage . . . bridges within the county, unless otherwise provided by law, and to grant franchises and licenses to collect tolls thereon.

"7. Whenever the cost of construction of any bridge . . . shall exceed the sum of $500 such work shall be done by contract, and any contract therefor shall be void unless the same shall be let as hereinafter provided. The Board of Supervisors shall adopt plans and specifications, strain sheets and working details therefor, and must advertise for bids for the performance of said work in a newspaper of general circulation published in the county for at least twenty days . . . and said board shall award the contract to the lowest responsible bidder . . . provided that for the construction of any bridge . . . if the board of supervisors shall be advised by the county surveyor or engineer that the work can be done for a sum less than the lowest responsible bid, it shall then be their privilege to reject all bids and to order the work done or structure built by day's work under the supervision and direction of said surveyor or engineer.

"41. To do and perform all other acts and things required by law not in this title enumerated or which may be necessary to the full discharge of the duties of the legislative authority of the county government."

The argument in this case circles around the proviso clause which authorizes the board, in the event that it shall be advised by the county surveyor that the work can be done for less than the lowest responsible bid, it shall then be the privilege of the board to reject all bids and to order the work done by day labor under the direction of the county surveyor or engineer. The word "engineer" appears in the section, as amended by the legislature providing for the appointment of county engineers instead of election of surveyors, but that amendment has been held inoperative in the case of Coulter v. Pool, 187 Cal. 181. The section must be read as though only the word "surveyor" occurred.

Section 4214 of the Political Code, to which we have adverted, specifies that the surveyor must be a licensed land surveyor of the state and must make any survey that may be required by order of court, or of the board of supervisors, etc. There is nothing in the section which contemplates the possession of any of the qualifications necessary to perform the services contemplated by the agreement entered into between the plaintiff and the board of supervisors of the county of Sutter. The making of field notes and plats of surveys, and the filing of them in certain offices, where they may be preserved for the benefit of the public, carries with it nothing that imports the possession of technical skill requisite to perform the services required of a construction engineer. Nor, do we think, that section 4219 of the Political Code trenches at all upon the powers of the board of supervisors. That section reads: "The surveyor shall make such surveys of county roads and perform such other engineering work as the board of supervisors may direct. . . . All such maps and field-notes of surveys shall be filed in the office of the surveyor and the same shall thereafter be and remain the property of the county. It shall be the duty of the surveyor to advise the board of supervisors regarding all engineering work and to perform such engineering work as may be required by the board of supervisors." The whole section has in view the making of field notes and matters of that kind as clearly shown by the second sentence, which, as we have seen, refers to maps, field notes of surveys, etc., being filed. There is not one word about building plans, the erection of structures of any kind, or the determining of any of the factors entering therein by the surveyor. That the surveyor may be consulted does not necessitate that his advice be followed. It is simply a matter of legislative discretion with the supervisors.

. . . It may further be noted that the board is given absolute power in the employment of persons qualified to prepare plans, specifications, strain sheets and working details and, when the work is done by contract, to dispense entirely with the services of the county surveyor. This to us necessarily implies the power of the board to employ someone competent to determine whether the structure contracted to be erected is being built according to the plans and the materials used therein, of the kind and quality, tensile strength, etc., called for by the specifications.

. . . In view of what has been said, we think the following premises laid down by the appellant sound: The contract is valid as within the authority of the board of supervisors; under the contract $2,000 was payable on Feb. 6, 1923; the supervisors, in approving the claim, took all proceedings required by law; their approval of the claim was conclusive on the courts that petitioner had performed sufficiently to entitle him to this payment; petitioner, in presenting plans and specifications, had done all that he was required to do by Feb. 6, 1923; that there is neither allegation nor element of fraud entering into this proceeding.

A 34-Story Steel-Frame Tower Building in Chicago

Column Layout to Fit Office Plans—Heavy Steel Work—Wind Bracing—Structural and Architectural Design

ARCHITECTURAL considerations governed the structural design of the Tribune Tower Building, at Chicago, to an extent unusual in office buildings, owing largely to the fact that the sectional plan is not of uniform shape or size, but changes at different elevations. In the upper part, of octagonal section and relatively small area, the architectural feature known as a flying buttress is introduced to flank the tall thin structure, and these buttresses require steel columns of special section. Where long spans and offset columns are required, heavy plate-girder construction is employed. Trusses are used only for 43-ft. spans carrying interior columns of the octagonal tower; these trusses, 12 ft. 4 in. deep, have their bottom and top chords in the 26th and 27th floors respectively. Steel grillage supports for offset columns in upper floors form another special feature in the structural arrangement.

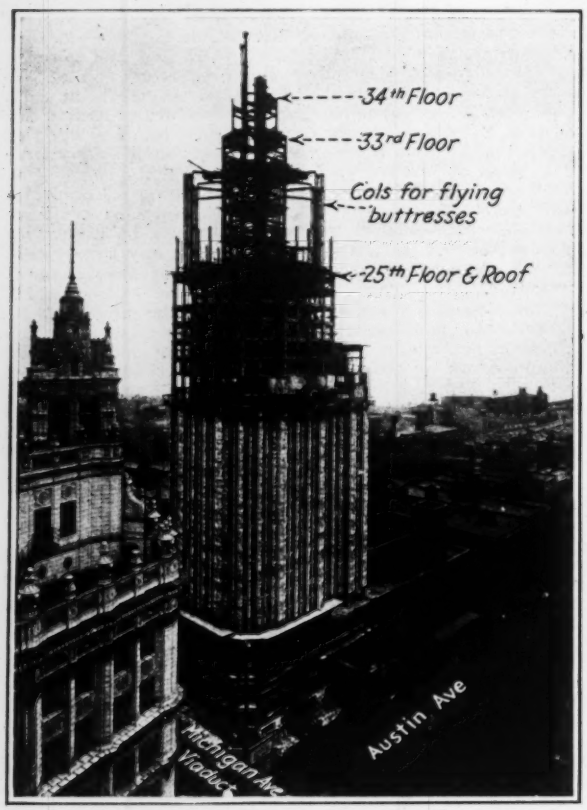


FIG. 1—TRIBUNE TOWER BUILDING, CHICAGO

Tall steel columns seated at main roof level are for the flying buttresses which flank the octagonal tower extending to the 34th floor. Note smokestack in center of tower, with steel erection derrick at left. At the extreme left is part of the roof of the Wrigley Building. A dark horizontal line in the background indicates the breakwater. The low annex at the right of the main structure contains the *Tribune* printing plant.

This building on the east side of Michigan Ave., and one block north of the Chicago River, is a 34-story office building about 450 ft. high from the first floor to the top of the lantern roof, above which rises a 110-ft. steel flagpole. The first floor, however, is at the level of the upper deck of the Michigan Ave. viaduct, with the basement at the main level of the streets. Seven basement and sub-basement floors, diminishing in area, extend to a total depth of 75 ft. below the first floor, or 41 ft. below the water level in the river. Special features of the foundation work and superstructure have been given in *Engineering News-Record* of Dec. 18, 1924, p. 982, and Feb. 19, 1925, p. 310. In the view of the nearly completed building, Fig. 1, the street at the right is one level below the first floor and the cars are standing in front of the *Tribune* printing plant. Just above the head of the masonry derrick at the left is the combined roof and 25th floor, above which is the octagonal tower. The tall columns around the edge of the 25th floor level are for the flying buttresses noted above.

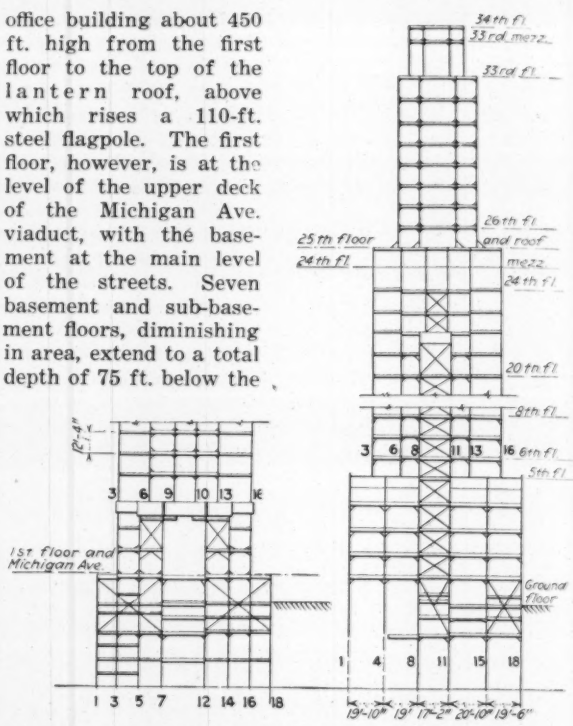


FIG. 2—SECTIONAL ELEVATIONS OF TRIBUNE TOWER BUILDING

Right elevation is on column line N, looking east and showing wind bracing in end of elevator shaft. Left elevation is on column line A, at Michigan Ave. front, looking east and showing heavy girders and bracing.

From the first to the fifth floor the building is approximately 100x136 ft., then 100x100 ft. to the 25th floor; above this it is of octagonal shape, 48 ft. in diameter to the 33rd floor, 35 ft. in diameter to the 34th and 16 ft. above the 34th floor, which is the lantern or pent house. Above the 26th floor the structure is primarily for monumental architectural effect, but incidentally it provides some desirable office space.

Column Layout—Below the first floor the arrangement and spacing of columns was governed largely by the printing plant in the basement, while on the first floor is the entrance lobby about 34x50 ft., having its ceiling a few feet above the third floor. Typical office floors begin, therefore, with the fourth floor. As explained by H. J. Burt, structural engineer, in a paper before the Western Society of Engineers, it was found that the original column arrangement, as provided for the lower stories, did not permit of a convenient or economical floor plan. At the fifth floor, also, a change in the wall lines, for the architectural treatment, neces-

situated the setting back of several columns. Furthermore, some of the interior columns had to be offset, particularly over the lobby, where four of the heaviest columns in the building had to carry a girder framing

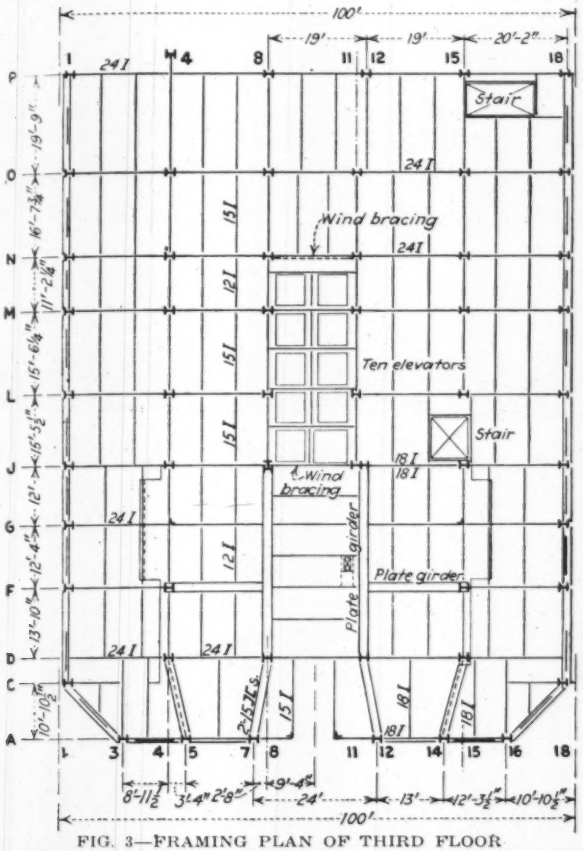


FIG. 3—FRAMING PLAN OF THIRD FLOOR

to support columns in the upper floors. Figs. 2 and 3 show some portions of the special framing.

It was not practicable to offset columns at the first floor, since the headroom over the presses and other machinery did not permit placing the necessary deep girders. For this reason, the main changes are made at the fourth and fifth floors. These conditions involved heavy and unsymmetrical girder framing, with intricate details and connections. In general, the columns are of H-section, composed of a web-plate, side plates and four angles. The relation of structural design to proper utilization of the floor or rental space in this building is illustrated by the following quotation from a paper on office building design by John M. Howells, one of the architects:

> On the floor plans we placed the elevators, stairs, toilets and other services in the center of the plan, with uninterrupted office space all around and windows all around the outside of the space. But the first plans showed a row of steel columns around the middle of office space. We made another set of plans, therefore, showing this space in one span, clear of columns and without ceiling beams. This meant more money and a good deal of it, because special beam sections and more steel had to be used.

Special Framing—The heaviest construction is required where the upper columns have to be supported over the lobby as indicated diagrammatically in Fig. 4. Here there are two 40-ft. double-plate girders 12 ft. deep (D-8 to J-8 and D-11 to J-11). Each girder, weighing 39 tons, supports a column (F-8 and F-11) near the middle and at the same point has framed against it the end of a single-web girder (F-8 to F-11) and a smaller double-web girder (F-4 to F-8 and F-11 to F-15). Each of these smaller double-web girders in turn supports an intermediate column (F-6 and F-13). The center of gravity of the loads comes approximately at the center line between the two webs of each main double girder, although the column which it supports is slightly off the center line. It was practicable, therefore, to make the double girders symmetrical, but the webs are connected at this point by two diaphragms which will take care of any slight inequality of load.

At the east end of each 40-ft. girder, at J-8 and J-11, there is a complicated connection with a double girder at the side and a column above. To meet this condition a supplemental column was introduced in each case to carry the weight of the side girder, this column being rigidly connected to the main column. The two double columns thus formed are not of similar section, as will be seen by Fig. 4 and the details in Fig. 6. On account of the thickness of metal and the difficulty of driving rivets at these points the girder connections are made with 1½-in. bolts. Floor framing is largely of I-beams.

At the third, fourth and fifth floors, changes in walls and chamfered corners of the building cause a shifting of many columns, some of them diagonally, while there is also a change in the spacing of the front columns. These conditions necessitated a complicated girder arrangement, and in order to avoid beveled connections on the webs, the diagonal girders across the

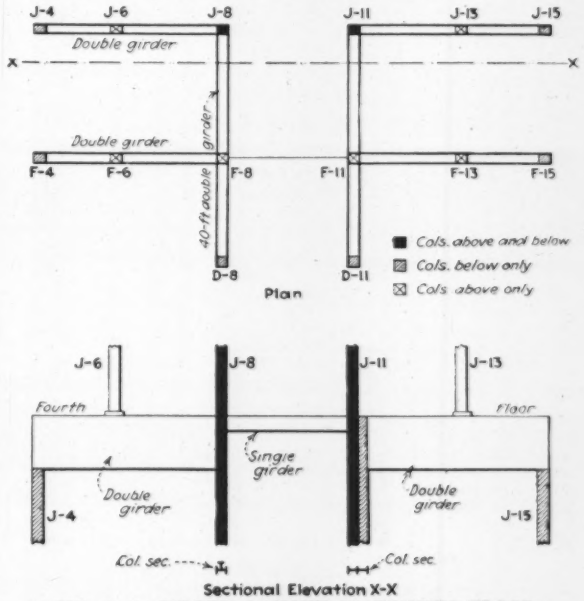


FIG. 4—A GIRDER LAYOUT IN FOURTH FLOOR

corners were set on top of their supporting girders instead of being framed between them.

At the main roof level, or 25th floor, a complete change in column arrangement is made, owing to the reduction in shape and size of the tower to a diameter of 48 ft. above this level. Since none of the columns are continuous above or below this floor, a complete grillage of girders and beams was placed to support

the framing of the superstructure, as shown in Fig. 5. A similar grillage was placed 90 ft. above, where the framing is again interrupted by a reduction in size to a diameter of 35 ft. Near the edges of the main roof rise eight octagonal columns for the architectural "flying buttresses" which extend to a height of 80 ft., flanking the tower section 40 ft. in diameter. Each of these columns, 76 ft. high, is an octagonal cage 7 ft. in diameter composed of eight ribs connected by latticing and has horizontal struts tied to the main framing (Fig. 6). Masonry encasing these columns extends in arch form from their heads to the masonry shell of the tower.

Wind Bracing—In view of its height, its relatively small sectional area and its exposure to the sweep of winds from the lake, it was important to provide not only against swaying but also to make the structure so rigid as to prevent unpleasant trembling or vibration. In general, this bracing is effected by bracketed girder connections or gussets at practically all lines of columns in both directions as in Fig. 6. The size and location of windows would not permit wall brackets large enough to take the entire load, so that it was necessary as well as desirable to use the interior column connections also.

Vertical diagonal bracing is provided in the east and west ends of the elevator shaft (Fig. 2), consisting mainly of pairs of 12-in. channels back to back. At a few points where it was necessary to offset the vertical planes of this bracing, horizontal diagonal members were worked into the floor, except where the floor construction was sufficient to carry the transfer of wind load. In the smaller top section of the tower, some of the vertical wind bracing consists of knee-braces. The steel frame is designed to stand a wind pressure of 30 lb. per sq.ft. on the entire projected area in both directions, although the city building ordinance specifies this pressure only for the towers of

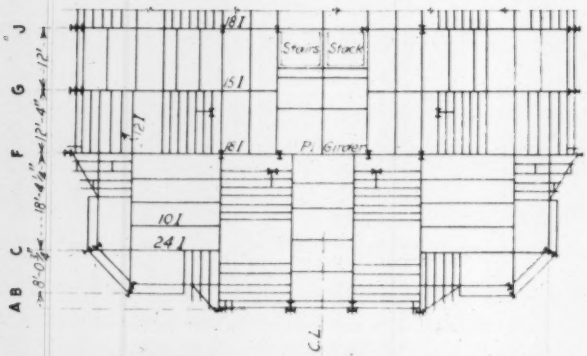


FIG. 5—GRILLAGE AT 25TH FLOOR CARRIES TOWER

buildings. All wind stresses are carried down to the sub-basement level, where there is ample earth resistance to take the horizontal shear.

Floor Construction—Steel floor framing consists of girders on all column lines and some sub-panel girders, with I-beams for the sub-division and carrying concrete floor slabs (Fig. 6). Wood flooring on the slabs was proposed originally for the office floors, 5 to 24, but later it was decided to use linoleum pasted on the concrete. This change effected a reduction in dead-load which was valuable when four stories were added to the design after construction had begun. Where marble or tile flooring is required, the concrete slab is depressed and finished surface is level with linoleum.

As the girders between the columns are of such span that they are too deep to be embedded in the floor thickness, the ceilings are panelled by these girders, but in

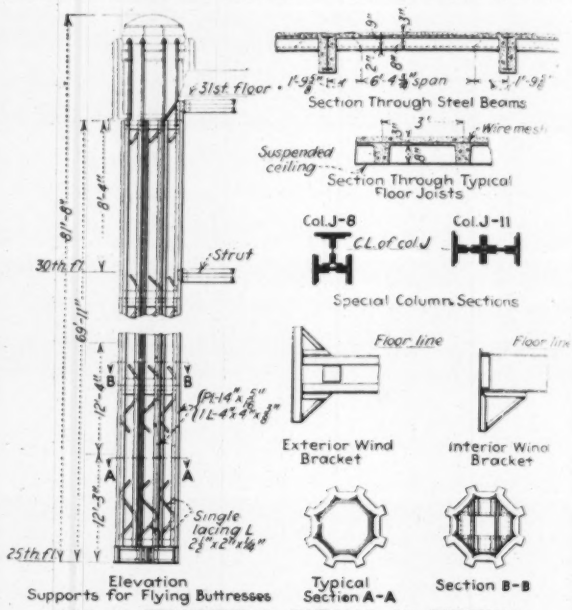


FIG. 6—STRUCTURAL DETAILS OF TRIBUNE TOWER BUILDING

most cases the girders are concealed in partition walls. Although panel lengths range from 11 to 26 ft., a uniform thickness of floor is employed. The reinforced-concrete floor consists of a 3-in. slab with 8-in. joists, making a total depth of 11 in. The joists are mainly 30 in. apart; in the corner panels they run in both directions, forming a cellular construction. All ceilings are furred beneath the joists. Steel removable forms were used for the floors. A live-load of 50 lb. per sq.ft. is provided for in all office floors, 100 lb. in the upper or tower floors, and from 100 to 250 lb. in the lower and basement floors.

The Tribune Tower Building was designed by Howells & Hood, architects, Chicago, who won the prize in the competition for architectural designs. But, as noted above, four stories were added later in the main body of the building. H. J. Burt, Chicago, was consulting structural engineer. The general contractors were the R. C. Wieboldt Co., Chicago, for the substructure, and Hegeman & Harris, New York, for the superstructure. The steel framing was fabricated by the American Bridge Co. and erected by the Overland Construction Co., Chicago.

St. Louis Water-Works Improvements

Contracts have been let for $4,000,000 worth of the proposed extensive improvements to the St. Louis Water-works, states E. E. Wall, commissioner. The cost of engineering and supervision thus far has been less than $120,000. This covers: All preliminary surveys and studies; final surveys for the location of buildings, pipe lines, river work; designing and letting contracts for the main improvement, engine pits and intakes, 16 miles of 60-in. steel pipe, five miles of hard surface roads, and railroad tracks and switches. In addition a large part of the design of settling basins, storage reservoir, filters, conduits and sewers has been completed.

Outstanding Practice Problems of the Profession

A Symposium of Engineering Opinion on Questions of Solicitation of Professional Engagements, Price-Competitions for Engineering Work, and Inadequate Fees

By D. B. Steinman
Consulting Engineer, New York City

IN ORDER to secure a consensus of opinion on certain problems affecting the standing and welfare of our profession, the American Association of Engineers recently addressed a hundred representative engineers of national reputation for their views on ethical conduct in negotiations for professional services. Specifically it asked, among other things, how far the engineer may solicit an engagement without invitation; whether he should decline to do so competitively; whether a warning against competition should be included in the code of engineering ethics; and what can be done by the profession to combat the evil of inadequate fees.

This questionnaire elicited a truly noteworthy response, representing the best thoughts of men of eminence in the engineering world. Believing that the views expressed and the ideas suggested merit careful study and consideration by the entire profession, the writer has prepared this article as a review of the replies received. The views recorded are the predominant or averaged opinions of the three-score leading engineers who contributed their thoughts.

Negotiations for Professional Engagements

On the first question, regarding the limitations of ethical procedure in negotiations for professional engagements, the individual replies stressed various points as violations of proper or honorable conduct. The following are typical excerpts:

> Where an engineer has been employed either to make a preliminary report or do anything in connection with a certain project, it is highly unethical for any other engineer to submit a price or attempt to get the work, or to take part in a competition where the owner is possibly looking for a lower price.—H. E. Riggs.
>
> There should be no ethical objection to an engineer's informing a prospective client of his readiness and fitness to undertake a commission, provided no other engineer has been engaged. He should make no effort to get work away from another.—J. R. Worcester.
>
> I consider it unethical for an engineer to submit estimates of cost for work on which he is not yet employed. —C. W. Hubbell.

From the scores of replies received, it appears that the following practices in attempts to secure engagements are to be regarded as unprofessional:

1. Trying to get an engagement away from another engineer.
2. Intruding where another engineer has been active in developing a project, or has been employed to make a preliminary report.
3. Intruding where another engineer has already been retained, or where negotiations for his engagement are about to be concluded.
4. Intruding where a limited list of other engineers have been invited for consideration.
5. Intruding where clearly not wanted.
6. Submitting a price or proposition for professional services without invitation.
7. Giving a cost-estimate or other gratuitous service before being retained.
8. Knowingly or intentionally underbidding another engineer.
9. Taking part in a price-competition.
10. Disparaging the character or ability of another engineer.
11. Undignified or self-laudatory advertising or solicitation of professional work, or self-glorifying newspaper interviews.
12. Paying commissions to others for recommending one's services.

Uninvited Solicitation

While the profession is in general agreement on the foregoing delimitation of ethical procedure, there is a diversity of opinion on the specific question of the propriety of uninvited solicitation of professional engagements by practicing engineers. The replies that definitely disapproved of uninvited approach are typified by the following:

> It is my belief that solicitation of business should be discouraged in every way possible, as I consider it not only unethical but it is bad business for individual engineers, as well as for the profession as a whole. —Alten S. Miller.
>
> Personally I do not feel that the engineer should make any special effort to secure an engagement for a given work when not invited to do so.—Wm. J. Wilgus.

The opposing views are well represented in the following replies:

> It is only the nationally acknowledged expert in any line of engineering who can afford to avoid all solicitation.—T. Chalkley Hatton.
>
> The practice of a professional engineer involves a certain amount of business deportment and, consequently, unless an engineer either directly or indirectly places himself in a position where he will be invited or even go so far as to ask for consideration, I am inclined to believe that he would find his professional business in rather a precarious position.—H. Robins Burroughs.

Clarifying the apparent difference of opinion represented by the preceding excerpts, the majority of replies took a middle ground by indicating that there is a line beyond which solicitation of professional work becomes improper. The need for a developed sense of ethical discrimination to guide the individual engineer in such matters was emphasized. The prevailing opinion was that limited approach is permissible, but that it should not go beyond making the engineer's availability known to prospective clients. The following are some expressions of this view:

> I think it is perfectly proper for an engineer to make known, to persons who might employ him, his experience in the field of his work. He should not, however, make any direct effort to secure a given piece of work without invitation, except to this extent.—George F. Swain.
>
> Concerning the extent to which it is proper for an engineer to solicit an engagement without invitation, I feel that it is in order only to make himself known. —Ernest P. Goodrich.
>
> I think it is entirely proper for an engineer to let it be known that he is in practice, and also, if he knows

of a new development, to place his name before those responsible for it so that they may know he is prepared to undertake the work if they elect to employ him. —NICHOLAS S. HILL, JR.

I think this effort should be limited to merely acquainting the parties who have charge of the work with the fact that the engineer is available. This is often helpful to such parties, who frequently are only vaguely informed as to who is qualified in a particular field. —H. K. BARROWS.

The dozens of similar replies indicate that we are not ready to adopt the rule of the British Institute of Consulting Engineers declaring all solicitation unprofessional. At the same time, it appears to be the consensus of opinion that uninvited efforts to secure professional engagements should be reduced to a minimum, and should be kept within certain defined limits.

The outstanding new thoughts developed in the foregoing discussion may be summarized in the following statement of principle:

> The engineer should avoid soliciting an engagement without invitation, beyond making himself known to a prospective client. He should never name a fee for prospective services before he is requested, nor give an estimate for any project before he is retained.

Unprofessional Competition

The engineers who responded were practically unanimous in denouncing the evil of price-competition for professional services. Conviction was expressed that no engineer entering such competitions can secure the compensation necessary to give proper service, also that such competitions seldom result in the selection of the right man for the work. It was the consensus of opinion that price-competition for engineering services is not only detrimental to the profession, but is also hurtful to the best interests of the public.

There is of course a natural and proper competition in quality of service rendered. Competition on the basis of qualifications promotes the selection of the best man for the work; but competition on the basis of fees charged interferes with a wise selection and with adequate compensation, and should therefore be discouraged and avoided.

It is certainly desirable to eliminate competition in price for professional work. The competition should be in the quality of work done.—ALLEN HAZEN.

It is recognized that a large part of the responsibility for competitive conditions rests on those who employ such methods for selecting professional services.

Those who employ engineers have also a duty, which they violate frequently. They should not go around trying to get the lowest price from some engineer for doing a projected piece of work, but should go to an engineer in whose uprightness, fairness and competence they have confidence.—GEORGE F. SWAIN.

A Specific Question—Although engineers are generally agreed that price-competition is an evil to be suppressed, there is a difference of opinion as to how far an engineer should be expected to go to avoid such competition. What is an individual engineer to do when he is asked to name a fee for a given work and knows or suspects that the same inquiry has been addressed to others? Is it proper to name a fee under such conditions?

This question evoked a wide range of replies. At one end of the range, a number gave an unqualified negative answer, as illustrated by the following:

Engineers should not name prices knowingly in competition with other engineers. As I consider it improper for invitations to be sent to engineers asking their fee in competition, the best engineers receiving such letters will not respond.—H. DE B. PARSONS.

At the other end of the range of responses are a number indicating an affirmative answer to the same question, as represented by the following:

An engineer can hardly avoid the necessity of quoting a price for doing a piece of work, when invited by a client, even though he may know that others have been asked the same question. The client may be entirely justified in asking prices from more than one. —J. R. WORCESTER.

Almost invariably, however, the affirmative answers are qualified by certain reservations. A study of these reservations, as emphasized in the following typical quotations, brings out the pivotal points of the problem:

If generally followed, it would result in a lowering of professional standards of fees. Only twice in my own experience have I received such an invitation and it was declined on both occasions for reasons satisfactory to myself. Both cases were obvious efforts to "shop around" to get the cheapest man obtainable but I do not believe that this, necessarily, is always the case when such invitations are issued.—ARTHUR M. SHAW.

When engineers are invited to submit propositions for their services in connection with special work, I can see nothing unethical in their submitting a proposition in which they state clearly the services which they propose to render and the fee which it is customary for them to charge for such services. But should an engineer learn either directly or indirectly what fee his competitor is naming for a job, and then should name a lower fee it becomes a case of unethical practice —J. E. GREINER.

I can see no valid objection to an engineer's stating his schedules of fees to a possible client, even though he knows other engineers have been asked for similar statements. It might be questionable practice for the engineer to reduce his standard schedule under such circumstances.—J. F. COLEMAN.

The ethics of the profession seems to me to be based upon each engineer's having a set price, so far as possible, for his services of different character, and naming that fee regardless of what other engineer may be invited to name a fee or may be interested in securing the work.—T. CHALKLEY HATTON.

In the replies represented by the last two quotations an essential thought is expressed. The engineer should not allow the fact that others are being considered to influence the fee named by him; to reduce his usual scale of charges under such circumstances is a violation of good professional conduct. In naming a fee, the engineer should decide upon a proper and adequate figure and should give no consideration to its possible effect upon his securing the work.

It is evident, from a comparison of the various replies, that the profession is not ready to give a categorical answer to the specific question under discussion. This is one of the questions on the shifting battle-line of engineering ethics, and merits careful consideration by all who are interested in the progressive raising of our professional standards.

Some Conclusions—On the basis of the replies, however, it is possible to formulate certain concrete conclusions that will represent conservative statements of guiding principles. From the following conclusions there appears to be no dissent:

1. Price-competition for professional services is not only detrimental to the profession, but is also hurtful to the best interests of the public.

2. The profession should do all it can to discourage conditions of price-competition among engineers.

3. It is the duty of engineers, by publicity and protest, to educate the public and prospective clients to avoid competitive methods of selecting professional services.

4. An engineer should decline to name a fee when he believes the invitation is an attempt to secure competitive prices.

5. It is distinctly unethical for an engineer knowingly to underbid another in naming a fee for a given work.

6. For an engineer to reduce his usual scale of charges under competitive conditions is a violation of good professional conduct.

Legality of Rules Against Competition

The replies to the questionnaire were practically unanimous in the opinion that a warning against unprofessional competition should be included in engineers' codes of ethics, and that legal objections to any such clause may be and should be ignored.

> I am heartily in sympathy with you in your desire to warn the profession against the conversion of its professional practice into an ordinary industrial business.—J. V. DAVIES.

> I cannot understand how professional services can come under statutes forbidding combinations in restraint of competition.—DANIEL L. TURNER.

> Professions are exempted under the common law from this statute. Certainly, neither the medicine nor the law are compelled to compete in professional services. It would be against public policy.—F. A. MOLITOR.

> The idea that refusal to name price is illegal and in restraint of trade is absurd for the very good reason that in engaging professional services it is manifest that the best public interest lies in securing the best quality of services rather than the cheapest service. —TERRELL BARTLETT.

The half hundred replies in this vein, with no dissenting comment, may be regarded as a conclusive indication of the best professional opinion on the policy and legality of adopting a rule against price-competition.

Existing and Proposed Rules

Some time ago, the Practice Committee of the American Association of Engineers, in its report on certain objectionable forms of invitation for professional proposals, crystalized its conclusions in a statement of principle which was worded as follows:

> "The engineer should maintain the professional attitude in negotiations for his services, and should decline to submit competitive bids for professional services or to furnish monetary guarantees of reliability as to estimates or otherwise."

To satisfy certain objections raised on legal grounds, indicating possible misinterpretation of the underlying spirit, this clause was restudied and the following revised and amplified statement was substituted:

> "The engineer should strive to give a full measure of service for the best interests of his client and of the public, and should charge fair and adequate fees for such service. He should maintain the professional attitude in negotiations for his services; and he should avoid all practices that have a tendency to affect adversely the amount, quality or disinterested nature of professional services, such as charging inadequate fees, competing on a price basis where (as is almost invariably the case) the service to be rendered or the character of its performance cannot be precisely defined, spending large sums in securing business, or consenting to furnish monetary guarantees of cost estimates."

This clause received the hearty approval of practically all of the leading engineers to whom it was submitted, and it has been incorporated in the Specific Principles of Good Professional Conduct of the association.

Supplementing this statement of principle, the writer suggests the following clause to cover additional thoughts brought out in the foregoing discussion:

> The engineer should avoid underbidding or reducing his usual charges when he knows that another engineer is being considered for the same work, and he should decline to name a fee when the invitation is presumably an attempt to secure competitive prices.

On the clause quoted from the code of the American Institute of Architects, namely:

> "Under no circumstances should experts knowingly name prices in competition with each other."

The responses indicated a marked division of opinion, indicating that our profession is not prepared to accept that rule without modification.

> Under existing conditions I do not believe it would be advisable for our profession to adopt that standard. If experts are asked for prices, they should give standard ones, as nearly as may be, even if they know that other engineers are being asked to compete.—J. A. L. WADDELL.

The clause covering this subject in the codes of the American Society of Civil Engineers and the American Institute of Consulting Engineers is as follows:

> "It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member: To compete with another engineer for employment on the basis of professional charges, by reducing his usual charges and attempting to underbid after being informed of the charges named by his competitor."

The qualifying phrases at the end of this clause practically destroy its effectiveness. This was recognized in several of the replies.

> I would omit the latter part of the sentence, thereby making unethical the competing with another engineer for employment on the basis of professional charges, without any qualifying conditions.—WM. J. WILGUS.

> I believe that the following should be lived up to by every engineer: "It will be considered unprofessional to compete for employment on the basis of professional charges by reducing his usual charge in the attempt to underbid his competitor." This is condensed from the code of the American Institute of Consulting Engineers.—HENRY R. BUCK.

The rule given in the code of the Western Society of Engineers was also cited:

> "Competition in professional work, where it enters in at all, should always be on the basis of efficiency in service rendered, and never knowingly in price concessions."

If a simple statement of principle is desired, the following condensed form (based on the rule of the A. S. C. E. and A. I. C. E., with the weakening phrases omitted) would probably cover the essentials to the satisfaction of all the engineers who have contributed to this discussion:

> The engineer should never compete with another engineer for employment on the basis of professional charges.

The Problem of Inadequate Fees

The question "What can the profession do to combat the evil of inadequate fees?" evoked a large number of helpful and constructive thoughts. The outstanding suggestions made, with supporting quotations, are as follows:

1. *Increase the respect of the public for the profession.*

The only way to increase the fees of the profession is to increase the respect of the public for the profession as a whole and for the individuals in it. If the engineers of a community are friendly and pulling together and are doing their share of public welfare work, they will be highly regarded by the public. If a client hears an engineer criticize a competitor it is natural that he should not only think less of the engineer criticized but of the maker of the criticism and even of the whole profession.—HENRY R. BUCK.

2. *Encourage rendering adequate service.*

The profession can encourage rendering adequate services. The rendering of such services would go far toward establishing adequate fees.—HARRISON P. EDDY.

3. *Improve the standards of the men in practice.*

These matters in my judgment may be reached only in improving the standards of the men actually in the practice, and while this would be a slow process we can each do our best to bring about the desirable result. —ALLEN HAZEN.

4. *Establish individual reputation for value of services.*

If an engineer, like a prominent lawyer, has training and experience and is qualified by ability and reasonable cultivation and dignity so as to be obviously an outstanding character in his profession, he will secure plenty of work and his clients will expect to pay him relatively speaking large fees. If on the other hand he has not been willing to make the self-sacrifices and perform hard work which successful men in all callings of life have to undertake and labels himself a commonplace man he would have less work and less fees. —WM. H. BURR.

5. *Educate those who employ engineers.*

Educate the people who require the services of engineers up to the point where they will recognize that it is as important to secure a good engineer as it is to secure a good physician or a good lawyer, and that good engineers cannot be secured at low rates by the use of competitive methods.—ALFRED E. FORSTALL.

6. *Establish standard fee schedules.*

The most important thing which the profession can do to combat the evil of inadequate fees is to make a rule against engineers' charging less than a given fee. Every time an engineer cuts fees it hurts the profession.—NICHOLAS S. HILL, JR.

Minimum Fee Schedules

On the last suggestion, to establish a rule against charging less than a given fee, opinions are divided.

I am certainly not in favor of establishing any schedule of minimum fees, as that would seem to bear too close a relationship to a union scale of wages. I think we must all recognize that there is an actual difference in the value of the professional work done by any two given engineers.—J. F. COLEMAN.

Upon analysis, however, the objections are found to apply to standardization of fees, rather than to the drafting of schedules of recommended minimum fees. If the latter represent honest estimates of the cost of rendering proper and adequate specified services, the adoption and publication of such fee schedules should serve a useful purpose: They furnish a guide to the engineer in estimating adequate charges for new work, and they show the client what he must expect to pay, as a minimum, in order to secure proper professional services. The primary function of published fee schedules is educational and advisory, and the violator soon learns that he pays the price in economic loss and in professional standing.

On the question whether it is practicable and legal to enforce minimum fee schedules by official action against violators, the responses, directly or indirectly, were in the negative. The outstanding thoughts expressed, with representative quotations, are as follows:

1. *Official enforcement is not practical nor legal.*

I do not think it is either practical or legal to proceed officially against men who offer to perform work below the schedule established by any organization.—H. E. RIGGS.

2. *Individual variations from fee schedules may be proper.*

The schedule may be fixed as a minimum which may control the profession similarly to the schedules of the A. I. A., but the more experienced and well-known the engineer becomes the higher are his fees, so what he might think was a cutting of the schedule by engineers of lower grade might cause discussion.—T. CHALKLEY HATTON.

3. *Fee schedules should be only advisory recommendations.*

In the matter of fee schedules, I do not feel that organizations should go farther than to recommend, and no effort should be made to make a proposed schedule mandatory. I believe that regulation of fees, excepting in cases of unfair competition, should be by advisory methods only.—ARTHUR M. SHAW.

4. *Observance of fee schedules is a matter of honor.*

An established schedule has no legal standing. Its observance is purely a matter of honor without which ethical conduct is impossible.—C. W. HUBBELL.

5. *Depend on moral suasion and the force of public opinion.*

I do not believe it possible to take official action against any member of the profession who has not been proven dishonest and I believe that, after having adopted a standard, it will be necessary to depend on moral suasion and the force of professional public opinion to accomplish the results.—ALTEN S. MILLER.

Conclusions on the Fee Problem

1. To combat the evil of inadequate fees, engineers, individually and collectively, should ever strive to raise the standards and the standing of the profession. Higher standards of ethics, qualifications and service will increase the respect of the public for the profession. Engineers must also establish individual reputations for the value of their services; by personal character, quality of performance, and refusal to cheapen their services, they will not only advance their personal success but will also enhance the public regard for the value of engineering services.

2. In addition, concerted efforts should be made to educate those who employ engineers in regard to proper methods of selecting professional services and proper standards of compensation. Professional organizations can issue informational sheets for the guidance of public bodies and other prospective clients, presenting standard fee schedules and arguments against price-competitions and inadequate fees.

3. The adoption and publication of standard schedules of minimum fees are desirable as a guide to the engineer and for the education of those who employ engineers. The observance of such schedules should be a matter of honor with the individual engineer, supplemented by moral suasion and the force of professional public opinion.

4. Practicing engineers should also do their share to raise the standards of compensation in the profession by maintaining high standards of pay for engineer employees and salaried assistants.

Certain Facts About Sunken Towing Boat "M. E. Norman"

Plans of Boat—Observations by Captain West of Mississippi River Commission—Photos of Site of Tragedy

By W. W. De Berard
Western Editor, *Engineering News-Record*, Chicago

FRIDAY, May 8, the towing boat *M. E. Norman*, recently purchased by the Mississippi River Commission, turned turtle and drowned 23 members of an engineer's convention 16 miles downstream from Memphis, 300 ft. from the Tennessee shore of the Mississippi River. What turned the boat over is the first question engineers ask after the human-interest queries have been satisfied. No one knows, though theories are rife. Col. C. L. Potter, president of the commission, and his engineers Majors D. H. Connolly and D. H. Gillette, with whom the writer spent the three days following the disaster, welcomed the views of expert and layman alike. To expedite the arrival at a solution they freely gave plans and all information asked for. The accompanying drawing and incidental notes will permit engineers to start deductions. A photograph is also shown of the place where the steamer sank and where methods were used to break up the cabin so that imprisoned or entangled bodies might be freed from the wreck and rise to the surface. From observations of Capt. Charles H. West, whose letter is noted elsewhere, and who later personally gave more details, it is unlikely that more than three or four persons were entrapped. The suction of the boat when it took its final plunge was tremendous, according to Captain West, and may have carried bodies down and into the wreckage.

Construction of the "Norman"—The *M. E. Norman* was designed by Capt. John R. Drackett of Morgan City, La. The Hogan Co., Morgan City, built the boat for the Norman-Breaux Lumber Co.; M. E. Norman, manager, supervised the design, construction and equipment. In a letter to the *Waterways Journal*, printed Feb. 14, D. Morgan, pilot, who delivered the boat to the commission at Memphis, says:

The hull is of steel, 115 ft. in length, 26 ft. wide, 4 ft. deep, and was built by the Hogan Boiler Works of Morgan City, La. The boilers, 16 ft. in length, 40 in. in diameter, with 30 flues, 3 in. in diameter, allowed 234 lb. steam. The engines, with 12-in. diameter and 6-ft. stroke, had balanced valve, California cutoff, pendulum motion. She has a Shelton doctor, built by Shelton, of Paducah, Ky.; Marietta capstan; directly connected General Electric light plant; in fact, all modern improvements.

This little boat is undoubtedly the most complete steamboat finished recently. Her first inspection was on Dec. 16, 1924.

We left Morgan City Jan. 20 and arrived in Memphis Feb. 3, after one of the smoothest trips it has ever been my privilege to make for a distance of over 700 miles, without any delay or detention caused by the machinery of the boat.

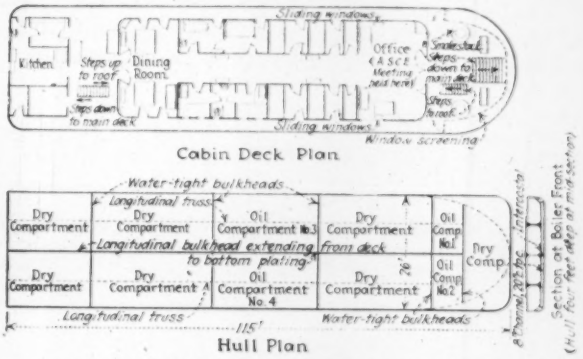
For a year or two the commission has been needing two boats. This spring when appropriations were available several were found and to save time of construction three were purchased, among them the *Norman*. In no case were specifications or detailed plans furnished, the commission depending on the U. S. Inspectors and examinations of the experts of the commission, all of whom passed the vessel.

The *Norman* was built to tow oil for the Texas Co. but the oil wells gave out or for some reason the Texas Co. shut down towing oil in this field. Delivery was delayed until the boat was completed and inspected.

Major W. M. Gardner, principal assistant engineer, who lost his life on the boat, and the master mechanic of the commission inspected and passed the boat at the shipyard. According to the U. S. certificate of enrollment and license, issued Jan. 15, its tonnage was gross 147 tons and net 97 tons. Mechanics who had occasion to work in the hull of the *Norman* after the oil tanks were filled say that there was no leakage of oil into the dry compartments. A very heavy oil was used.

The drawings shown herewith are based on a crude plan furnished by the boat's builders, with additions made by the commission's draftsman to indicate the screening around the bow.

An unofficial letter to Colonel Potter from Captain West, written May 11, three days after the disaster,



STEAMER *NORMAN* AS OUTFITTED BY MISSISSIPPI RIVER COMMISSION

American Society members were crowded into the "office," forward of the cabins. A few people, mostly women, it is said, were just outside. James Wood, his wife and a number not members, were aft. The screen around the forward deck was torn away in places. W. G. Stromquist reported its bearing against his face as he was carried under. Steam siphons to all "dry compartments" were operated and the hull declared "dry" by the superintendent of floating equipment one hour before the boat was boarded.

recites the personal experience of one who is probably as well able to give an accurate account as anyone on the boat. Everything that he says, so far as came under the observation of all those interviewed immediately following the wreck and for three days thereafter, is fully corroborated. This is especially true of the remarkable coolness of the passengers and efficient directions and command of the situation by Majors Connolly and Gillette.

Thinking it may be of interest I am giving this short statement of my experience and what I saw during the disaster when the steamer *Norman* capsized off Josie Harris Island about 16 miles below Memphis, on the afternoon of May 8.

I had looked over the boat with Major Connolly on the way down the river from Memphis and she appeared to be a very staunch craft. However, I noticed that she had practically no freeboard and once or twice she careened to one side so that the lower deck dipped below the surface of the water. I spoke to Major Connolly about this but he assured me that the inspection of the boat showed that she was all right in every particular, had a steel hull, was well balanced with oil and there was no danger of overturning.

On the way up returning from the revetment work at Cow Island Bend the members of the American Society of Civil Engineers on board assembled in the cabin for a discussion. The ladies and few children aboard were at the time mostly in the screened area immediately in front of the cabin while a few engineers and others who were not attending the meeting in the cabin were on the outside and some on the hurricane deck. It was during the meeting that the

boat careened to starboard. Everyone noticed it and a moment later when she did not right herself the engineers left the cabin, most of them going into the screen area immediately to the front.

I was near the front and among the first out of the cabin. Looking down the stairway leading to the lower deck I saw the bow of the boat was under water and the whole craft listed decidedly to starboard. Major Connolly and myself both said to the people, "Go to the high side, go quickly but don't rush." They moved in a most orderly manner without the least excitement. The boat was headed upstream and toward the bank. I remained near the center of the cabin deck and just as I was turning to go to the high side and out on the guard a man near me pointed to a pile of life preservers against the front wall of the cabin on the floor near the starboard side, and remarked "Let's get those for the people." We both rushed to the pile of life preservers, but before reaching them the upper deck on that side went under water and in an instant the boat was upside down and we were like fish in a trap some 15 or more feet under water. How many others were trapped in the same way when the boat turned turtle I could not tell, as it all occurred in a moment after the upper deck dipped under water. It was like a boiling cauldron in there and I was hurled in several directions. Then I found myself feeling along what had been the upper deck floor but was then overhead, and in some miraculous way found a hole through which I escaped and came to the surface. When I came up I was within a few feet of the upturned bottom of the hull. A good many people, men, women and some children, were on the hull and others being pulled onto it. There was nothing to take hold of, but a lady, Mrs. C. W. Okey, lying on her stomach, reached over and caught one of my hands and held me until the men pulled me up onto the keel.

An instant later a pile of life-preservers came to the surface alongside the hull. They were quickly secured and nearly everybody got one. One of the men who had pulled me out of the water, C. W. Okey, gave me a life preserver which I had gotten only partially on when the hull suddenly disappeared from beneath us. A man near me who had no life preserver and who did not know of my exhausted condition from having been under water so long, said in a quiet manner, "I will hold to you." We, of course, went down, but for some reason his hold on me was relaesed and I came rapidly to the surface in the midst of heads floating around in every direction. I finally got hold of the life preserver, pulled it around in place and succeeded in getting one of the strings fastened.

The current was very swift and nearly parallel with though setting slightly away from the bank, as well as I could tell. After a few moments I could see none of the heads and did not know what had become of the people. Having been twice under the water for so long I was nearly exhausted but able to keep a slight movement of arms and legs and tried to flank in towards the bank, conserving as much as possible the little strength I had left.

It was a mile or more below where the boat capsized when I heard a woman's voice, "Give me your hand, give me your hand." Turning I saw a woman headed in my direction a perhaps 6 ft. behind me. At that instant the motor b with the negro, Tom Lee, and several men and women wh he had picked up, rounded to near me and pulled us abro The young lady, who I later learned was Miss Marga Oates of Memphis, was the only woman on the bottom of hull when it disappeared who had not gotten a life p server, and naturally she was nearly exhausted when pick up. I was completely exhausted when taken on the laun The next one taken aboard was Professor Kirkpatri Efforts were made to revive him but he died a few momen after we were taken ashore.

The man who was with me the moment the *Norma* turned upside down, escaped from the inclosure and throug the same opening I did, as I learned from him that night I am not certain, but think this was G. W. Miller. I am quite sure that no one else who was trapped in the same way escaped. [Capt. West on May 13 met Mr. Miller and checked the above.]

I saw some heartrending scenes and many brave acts. There was at no time any excitement, even in moments of greatest peril, and the heroic, unselfish action of women as well as men was marvelous. Always the stronger made efforts to help the weaker or those who were in more imminent danger than ourselves.

COAHOMA BEND AT POINT WHERE *NORMAN* SANK

Derrick boat above *Norman*, about 300 ft. off shore. Current sets against caving bank at right. Coahoma light on top of bank which is 15 to 20 ft. high.

As my watch stopped at 4:55 p.m. that or a little before must have been the time the disaster occurred. [The ship's clock, later recovered, stopped at 4:50 p.m.] The survivors collected around two campfires, one opposite where the boat capsized and the other about a mile and a half farther down. Those at the lower camp moved to the upper camp about nightfall, where we all awaited the arrival of some boat to take us to Memphis.

The first boat to arrive was the steamer *Monator*, sent from the Cow Island Bend revetment works; the next was the *Chisca* which returned from Memphis and immediately after her Major Stickney arrived with the steamer *Mississippi* and a number of doctors, nurses, policemen and others from Memphis. All possible aid was given the survivors on the way up to Memphis where they were taken in autos to their respective hotels and homes. Too much praise cannot be given for the kindness shown by the officials and people of Memphis in trying to alleviate the condition of the survivors.

I am quite sure that not the slightest blame for the horrible and unaccountable disaster can be attached to anyone on board the steamer *Norman*. Immediately before the boat capsized and during the dangers and after all who were saved were on shore, Major Connolly as well as Major Gillette gave their entire attention to their duty in helping others and with no apparent thought of safety and comfort for self.

Captain West, appointed a member in 1910 by President Taft, is chairman of four of the six standing committees of the Mississippi River Commission: Gages and high waters, construction, levees, and publications.

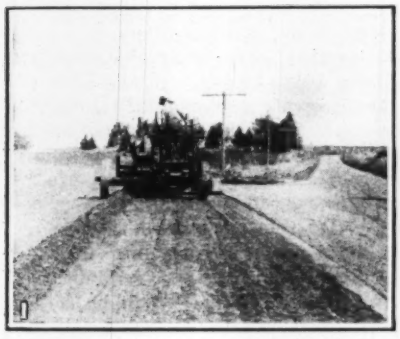
On May 14 he called at the Chicago office of *Engineering News-Record* on his way back to the river to board a boat of about the same size as the *Norman* for an inspection trip. His hands were shaky, his limbs stiff from exposure and he sat down with difficulty. Despite his 67 years he was reporting for duty and it is certain will complete his inspection without request for release. The Engineer Department, both the corps of Engineers and its civil engineers of which Captain West is one, is manned by sturdy loyal stock.

New Asphalt Surface Treatment for Gravel Roads

Extract from the report of the Committee on Maintenance of the Highway Research Council.

DURING 1923 one mile of gravel road surfacing by a special method was tried on a trunk highway between Madison and Sun Prairie, Wis. This required no additional treatment in 1924, and the only repairs necessary were a few patches along the shoulders. In 1924 the treatment was given to 12 miles on the Middleton-Sauk City road as follows:

The gravel road is first shaped up to a uniform cross-section with a large blade grader outfit. When this is completed, the first application of tar, consisting of ½ to ¾ gal. per square yard, is placed on one-half of the road. The distributor is immediately followed by a large blade grader outfit with the blade set at quite a sharp angle and at a depth sufficient to grade over all surface materials in contact with the freshly applied tar. In most cases this is about ½ to ¾ in.



TREATING GRAVEL ROAD WITH ASPHALT BY NEW METHOD, IN WISCONSIN

Fig. 1—Grading tarred surface into windrow. Fig. 2—Shoving back the windrow. Fig. 3—Four hours later—fine traveling

Fig. 1 shows the manner in which the grader pushes the material to the center of the road. After this operation is completed, the distributor passes over the road again and distributes another ½ gal. per square yard on the new subgrade. Fig. 2 shows the next operation which consists in grading the material which was placed in the windrow in the center of the road back over the second application of tar. When this is done, one-half of the road is completed and the same process is followed for the other half of the road.

When the entire road has been treated, the grader outfit is kept on the surface smoothing the material out so that it will properly iron out under traffic. Fig. 3 shows the surface of the treated road about four hours after the treatment was originally started. After two days' travel, the surface is so completely ironed out that it looks like the average bituminous macadam road.

An advantage in this treatment over the common treatment for this class of road is that it does away with the sanding operation, which eliminates considerable labor and time and about 50 cu.yd. of sand per mile. If last year's experiment is a fair example of how the road will stand up, the annual scarifying operations will also be eliminated, and it will probably be necessary to give only a light treatment every second year. There is considerably more tar used in the original application in this method, but it is believed that over a period of years the cost of maintaining will probably be less than by the usual treatment and the inconvenience to travel is cut down to a minimum.

Pneumatic Handling of Granulated Chemicals

By Arthur F. Mellen

Filtration Engineer in Charge of Water Purification, Water-Works Department, Minneapolis, Minn.

USE of granulated filter alum with dry-feed proportioning machines has grown to such proportions in water-works practice in recent years that the storage and handling of the chemical, commonly sold in 200 lb. sacks, has presented certain difficulties. Storage originally designed for lump alum often may not be at all suitable for granulated alum in sacks. The problem may be solved by the use of granulated bulk alum if the difficulties of conveying can be overcome. Storage for bulk chemicals has usually been arranged with reference to convenience in making up solutions but may be very inconvenient as regards the location of dry-feed machines.

A good deal of study has been given recently by the writer, at the Columbia Heights filtration plant at Minneapolis, Minn., to the possibility of pneumatic conveying of granulated filter alum, first in unloading the chemical and elevating it to the bins, and second in conveying it from storage to the dry-feed machines. The chief advantages to be gained are: (1) Reducing the cost by purchasing in bulk quantities. (2) Reducing the cost of unloading or delivering from storage where conveying has to be used. (3) Low maintenance cost. (4) Dustless handling of chemicals which as now handled cause a considerable nuisance because of excessive dust in the air and consequent deterioration of exposed metals. (5) Conveying over long distances horizontally or vertically where necessary. (6) Dry-feed machines may be placed where desired for convenience and advantage of attention by the operators.

Adapting a new method is often more easily worked out in a new plant than in one already in service. Consideration of this method has been given in the design of our Fridley filtration plant, which is now under construction. Bids for the equipment have not been let as yet, but the design is committed to the pneumatic conveying of bulk granulated alum from the storage bins to the hoppers of the dry-feed machines. Unloading will be by gravity. As this method has found a wide application in many industrial plants and can be used with filter alum, iron sulphate, lime or soda ash.

Engineering in the Small City

A series of notes from the field on the Problems and Practices of the Municipal Engineer in the Cities Below 100,000

The Editor Visits the City Engineer

Snapshots of Our Representative Small Cities

Elmira, N. Y.

THE COUNTY SEAT OF CHEMUNG COUNTY, N. Y., 147 miles southeast of Buffalo. Lies in the flat valley of the Chemung River. Industrial plants include railroad car shops and those for manufacture of structural iron and steel, boots and shoes, automobile parts, silk and knit goods, dyestuffs, fire engines, and glassware. Incorporated as the village of Newton in 1815, and reincorporated as village of Elmira in 1828. Chartered as a city in 1864. Pop. (est. 1924) 45,000.

ELMIRA is a city whose charter provisions have bestowed upon its principal engineering officer complete control of only one of the several engineering requirements of a city. The preliminary studies of the design, the construction, and the maintenance of sewers are by law an obligation of the city engineer; his other duties are vague and incomplete. Construction of pavements (which include hard-surfaced alleys) is for instance a city engineering function but maintenance is not. Except for application of patches on certain soft pavements, the only maintenance job the city engineer has is concerned with sewers.

Organization and Financing—The city engineer's office is a bureau of the Board of Public Works. This board has a superintendent appointed by it. The city engineer is also an appointee of this board. The city engineer and the superintendent of public works are therefore on about a parity so far as administrative functions are concerned. The superintendent of public works, however, is frequently a politician looking for a plum, while the city engineer is not at all a center of political preference. As a matter of fact, Thurber A. Brown has been "assistant and acting city engineer" since 1906. In 1904 he was made an assistant city engineer and upon the resignation of the then city engineer he was appointed acting city engineer. The combination title has never been removed or revised, though he heads the engineering department and undoubtedly should be called the city engineer.

The city budget, divided into general, sewer, pavements and sidewalks, lighting, police and fire funds, runs pretty close to the constitutional debt limit, though the 1924 budget was $654,000± on an assessed valuation of $39,000,000.

Bond issues have been provided from time to time for both street and sewer work. Since 1921 the city has expended $600,000 for hard-surfaced paving. Most of the paving which has been laid since 1917 has been bitulithic. This type is recommended by the city engineer and selected by the Board of Public Works upon the theory that the aggregate grading seems to give better results than any other asphaltic type.

Streets and Surveying—With streets and sewers its chief engineering consideration, and with very few sewer extensions being made, Mr. Brown's chief function in the last few years has been the construction of pavements. The first sewer work in the city was done in the late sixties, but until the early eighties all was trunk-line installation. Following out a plan suggested by Julius W. Adams, an interceptor was begun in 1883 and the city now has a simple gravity sewer system composing 88 miles. The system is a combined one. Since the town is so flat gradients are low, in a few sections the gradients running as low as 0.1 per cent; and seldom above 0.3 per cent.

With his technical functions restricted to rather narrow limits, Mr. Brown finds himself shouldering a number of responsibilities which strict interpretation of the charter provisions might not bestow upon him. However, his is a long service in municipal administration and such a thorough knowledge does he possess of the city's engineering features and history that his judgment is invaluable in controversial matters.

The original surveys of the city, in the light of more accurate surveying methods, contained many discrepancies in block measurement. These surveys showed an almost invariable extra block-length. In the resurveying it has been Mr. Brown's responsibility to get all the facts together and then make a more or less arbitrary determination of the exact land lines and lot corners. This extra block length has given rise, in making assessment surveys, to what Mr. Brown calls "adjusted frontage." By this adjustment a man may get a foot or two more property than his deed calls for. When he finds out, he is usually jubilant, until he is assessed for 67 ft. of frontage which he actually possesses, instead of 65 ft. which his deed calls for. Inasmuch as considerable street and sewer work has been done in the city in the last eight or ten years, the adjustment of this frontage for every block so resurveyed has involved numerous controversies. The equity exercised by Mr. Brown has apparently become well established for scarcely ever is a contest over adjusted frontage carried to court.

Water-Supply and Garbage Disposal—In making an examination of small city technical administration one is apt to get well fixed in his mind the notion that engineers are hired by the city for using their technical knowledge and experience alone, and not for any potential executive ability they may possess. There is nothing in Elmira to defeat this notion. For instance, water supply is administered by a business board which contains no engineers, and employs few except as minor plant attendants. Four "successful business men" and one physician comprise the water board, and the general manager of the plant is the former accountant for the utility whose plant was taken over by the city a number of years ago. Earth road maintenance, garbage disposal, maintenance of the four city bridges crossing the Chemung also have non-technical supervision. However, the city engineering department is available to any city bureau for what technical advice is needed, although there is no obligation to follow it. As engineering adviser to the Board of Public Works, the city

engineer has a certain influence in the selection of pavement type and type of bridge paving. In this connection the Board of Public Works has sole administration of the sewer, pavement and sidewalk funds. It chooses the type of pavement to be laid without any advice or action on the part of the aldermen. The advantages for quick action in this arrangement are apparent, but also are the possibilities for abuse.

Garbage disposal in Elmira is a matter of forced city collection. This work is entirely under the supervision of the superintendent of public works. Several years ago the city made a contract with a company for collection for hog feeding, but the contractor failed. The public, accustomed to regular collection, insisted on collection by the city. Recently the city has purchased a 250-acre farm in the northeast edge of the town primarily for a garbage dump. The land was formerly worked as a brickyard and there is one 5-acre plot dug to a depth of 6 to 8 ft., which can be used as a natural dump with very little labor involved for filling. Overburden can be used as garbage covering and as the city is paying an enormous price for earth covering for garbage at its present dump, garbage disposal costs will undoubtedly show a decrease for the current year. Eventually other means of disposal will have to be undertaken and it is quite possible that incineration will be the ultimate process.

Earth Roads—Elmira has had rather an interesting experience with earth roads. In 1917 the city laid some 40 miles of cinder surfacing. Such roads usually were laid with 6 in. of uncrushed cinders the first season. Sometimes the street was graded first and sometimes not. During the first season the cinders were rolled and wetted. The next year when consolidation and crushing had been fairly well accomplished, heavy road oil was applied—¼ gal. to the square yard. At the present time cinder roads are costing too much to maintain and it is probable that the garbage farm will be used as a source of aggregate for road construction, at great saving in cost.

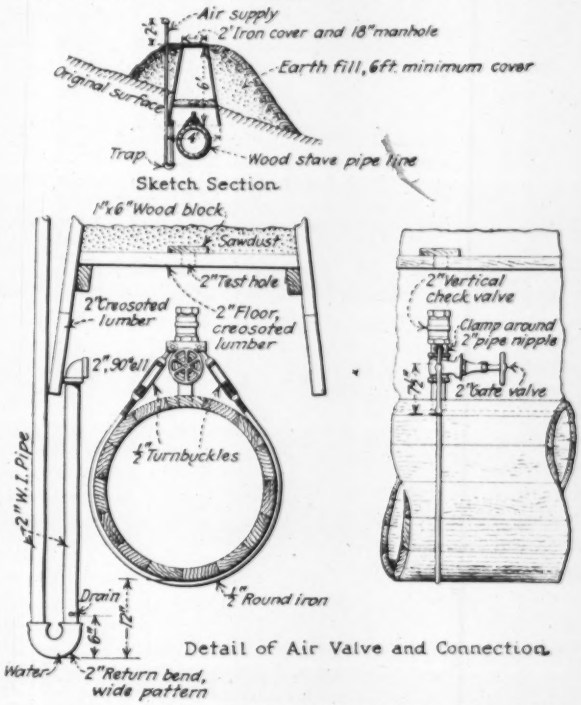
Though all of the street construction is contract work, the city has its own crushers at the garbage farm and will supply aggregate to contractors on street and sewer work, making it a stipulation in the contract that such local materials be used, provided strength and other tests prove the value of this local material for such uses.

Vertical Check Valves Used As Air Valves on Supply Mains

By Eugene Carroll
Vice-President and Manager, Butte Water Co., Butte, Mont.

VERTICAL check valves have given good service as air valves on the 73 miles of gravity and pumping supply mains of the Butte Water Co., which serve the city of Butte, Mont., and vicinity. The principal part of the supply is from two sources, one a storage reservoir 13 miles south of the city, and the other a pumping plant on the Big Hole River about 27 miles south and west of the city. The two gravity supply mains from the storage reservoir have 98,489 ft. of 24-in. continuous-stave wood pipe, while the Big Hole supply is delivered through duplicate force mains consisting of 133,366 ft. of 24-in. banded continuous-stave pipe, 86,924 ft. of 26-in. banded continuous-stave pipe and 64,137 ft. of 26-in. steel pipe. All of these lines are constructed over mountainous regions and have numerous summits and low points. At all the main summits automatic air and vacuum valves are provided and at all the principal depressions blowoff valves have been set. The air valves are kept closed so long as there is pressure in the main line, but in case of a break in the pipe line they open quickly to admit air.

In setting the vertical check valves which serve as air valves our method is to insert a 2-in. nipple at the top of the main pipe, to which is screwed (1) a 2-in. gate valve and (2) a short nipple to which is attached the



AIR VENT AND VACUUM VALVE, BUTTE WATER CO.
Valve chamber has air supply pipe with water trap which admits air when needed and otherwise excludes it and prevents freezing of water in air valve.

check valve, the whole being held in place by a band extending around the main line, set up with two single turnbuckles on each side.

This installation has been very satisfactory, when kept in working order. In this climate, where we have long and severe winters, we have experienced much difficulty in protecting these air valves against freezing, at the same time providing sufficient air for them to operate successfully in case of emergency. We have found that a direct connection to the outside of the valve chamber permits enough cold air to enter to freeze the water in the check valves.

To overcome this trouble we have designed an outside air connection, as shown in the sketch, which is sealed with a water trap at such a depth that the water never freezes in the trap. The valve box is an ordinary square box made of creosoted lumber with a cast-iron manhole in the top. A false bottom placed 6 in. above the check valve is covered with 6 in. of sawdust which can be easily removed at times of inspection. A 2-in. hole directly over the check valve is bored for the purpose of inspection. A 2-in. pipe to admit air to the chamber in case of necessity is carried down about 6 in. below the bottom of the main pipe to a double elbow, which forms a water trap at the bottom of the air pipe at a point where there is no possibility of frost reach-

ing it. A small drain hole is bored in the trap 6 in. above the bottom to regulate the amount of water in the trap. With this installation none of the cold air from the outside can possibly enter the valve chamber, and when a vacuum is formed in the main line, causing the check valve to open, the air is sucked through the water trap and sufficient admitted to answer the purpose for which it is intended, the reverse operation taking place as the air is forced from the pipe in closing the valve.

It is our custom to inspect these installations about once a year and to oil the stems of the check valves to make sure that they will work smoothly and quickly without friction and also to prevent them from rusting. We have 108 of these installations on our four main pipe lines, and have had no trouble since we adopted the present plan.

Fills Replace Piles Under City Streets in Astoria, Ore.

A UNIQUE problem confronted the officials of the city of Astoria, Ore., when they undertook the work of reconstruction after the fire of Dec. 8, 1922. The fire, which was reported in *Engineering News-Record*, Dec. 14, 1922, p. 1041, had destroyed not only the buildings of the business district extending over an area of 32 blocks, but the streets as well, together with the public service utilities such as sewers, water mains and power and light lines. This complete destruction resulted from the fact that the greater part of this portion of the city was built originally on piling over tide flats. A majority of the buildings were of wood-frame construction and many of the basements were not enclosed. In 1916 a sea wall had been erected in front of this district and a fill made by pumping sand from the river to an elevation of approximately 10 ft. below the street grade. Upon this fill streets were built as viaducts of creosoted timber with plank floors carrying bitulithic pavement and reinforced-concrete walks.

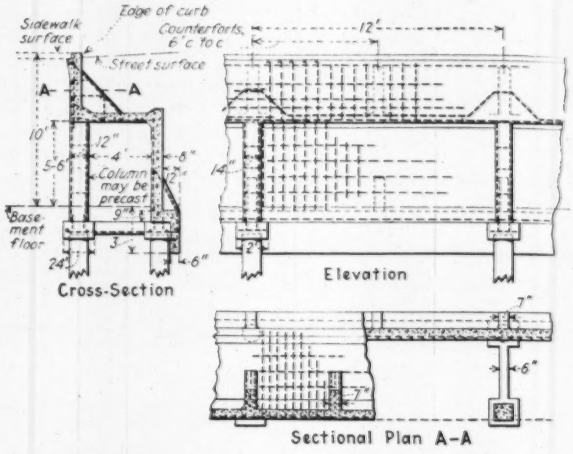
After the fire of 1922 the problem of the city's engineering force was to plan the reconstruction of the burned area so that a recurrence of the complete destruction by fire would be impossible. To that end reinforced-concrete retaining walls were constructed along the curb line of the streets, and sand from the river was pumped in between the walls. These walls averaged 12 ft. in height and are supported on piling bents driven on 12-ft. centers and penetrating to a depth of from 30 to 75 ft. The walls used, patented by Taggart Aston, Portland, Ore., consist of a concrete structure supported on piles and designed to employ a step-like construction such that a 4x5½-ft. space open to the basement is excluded from the street fill.

The dominant reasons for adopting this type of street construction were: (1) To provide space for the various public utilities so as to remove as nearly as possible all pipes and wires from under the paved streets, thus making them accessible without excavation of the streets; (2) to provide space under the sidewalk for the use of the property owners in taking merchandise and fuel in and out of buildings, there being no alleys.

The streets, which in the burned district were originally 50 ft. in width, were widened; the east and west or main streets to 70 ft. and the north and south or cross streets to 60 ft. The former were paved with an 8-in. concrete pavement 44 ft. wide and two 13-ft. concrete sidewalks, and on the latter the paving was made 36 ft. wide with 12-ft. walks.

Widening the streets necessitated the relaying of sewers, and these were placed in the retaining wall ducts described above, or in concrete tunnels in the streets built before making street fills. Large water mains of cast-iron pipe were constructed for fire protection on the south side of all east and west streets, with fire hydrants at each intersection; on the north side of these streets smaller service mains were built with cross feeds at each cross street with plenty of shut-off gates to control the water in each block.

In the several blocks within the burned district that



DETAILS OF RETAINING WALL CONTAINING UTILITY DUCT

were on solid ground streets were widened, burned pavement repaired, and walks rebuilt.

The city has also installed throughout the whole business district an ornamental street-lighting system consisting of 6,000-lumen lamps mounted on 18-ft. metal posts spaced 100 ft. center to center. The system is controlled from a transformer station located centrally under the elevated concrete sidewalk. A complete police and fire alarm system has been constructed. A new building code adopted after the fire requires all new buildings in the business section to be of fireproof construction, and all buildings are now of that type. The street-car system has been replaced by a privately operated motor bus line.

The cost of improvements in the burned district were:

Retaining walls (10,144 ft.) and sewers	$300,000
Fill (53,229 cu.yd.)	60,000
Walks (99,032 sq.ft.) and paving (26,294 sq.yd.)	200,000
Lights	80,000
Water mains	60,000
Redressing fringe streets	120,000
Miscellaneous cleaning up and other repairs	50,000
Police and fire alarm	20,000
Total	$890,000

Building permits for the past two years since the fire have totaled $3,187,429, and new buildings, finished or under construction, include in addition over 70 commercial structures averaging two stories in height.

In addition to the work done in the burned area the city of Astoria has constructed other street improvements during the past year at a cost of $245,000. Contract also has been let for constructing a 4,200-ft. sea wall and filling in the tide flats in the western part of the city. The fill, which will be made by pumping sand from the river, will amount to about 1,000,000 cu.yd.

Astoria is operated on the city manager plan, O. A. Kratz, city manager, R. A. McClanathan, city engineer.

Engineering Literature

A MONTHLY REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Incidents in a Long Engineering Career

SIXTY-THREE YEARS OF ENGINEERING: Scientific and Social Work—By Sir Francis Fox, M. Inst. C. E., Hon. Assoc. Royal Institute of British Architects. London: John Murray. Cloth; 6 x 9 in.; pp. 338; 20 halftones, 28 line cuts. 18s. net.

The English are natural autobiographers. Apparently every Englishman who reaches the scriptural limit of years possessed of enough funds to place him outside the benefits of the dole begins to set down for posterity the story of his life. And every other one finds a publisher. By the operation of the law of chance, some of these survivors are engineers, so we have in English literature that which American literature lacks, the engineering autobiography. British engineers are the gainers thereby, for the autobiography, well done, is a most fascinating form of literature, and when it is about the life and work of a man in one's own field of endeavor it is doubly so.

Sir Francis Fox's autobiography, noted in the headpiece, has prompted these reflections. Sir Francis is one of Britain's most eminent engineers, but he has more than his own career to draw upon, for his opening sentence reads: "Sixty-three years ago I began work with my father, the late Sir Charles Fox, and my brother, the late Sir Douglas Fox"—a famous engineering family.

His professional experiences thus cover more than threescore years, and include engineering work on many continents and in diverse practice. He discusses them under these heads, railways and tunnels, ancient buildings, and a final one covering what is left. Under Railways and Tunnels, he tells about the Victoria Bridge, Mersey Tunnel at Liverpool, work on various railways, including the London tubes; the Simplon Tunnel, railway work in South Africa and Canada, the Panama Canal, and the projected tunnel between England and France, in which Sir Francis is a firm believer. As to the last our author has no mean vision for an octogenarian, as the following quotation shows:

"It may seem to us today a very remarkable prospect, but it is by no means unlikely that within a comparatively few years travelers from London will be able to reach the most distant places in Europe, the most eastern parts of Asia, North and South Africa, India and China, without leaving the railway systems of the world. In the linking of the world's railways the channel tunnel will play an important part. It will stimulate trade as well as travel, and contribute to that growth of international understanding which can alone prevent the repetition of war."

In the second division of his book, Ancient Building, the author justly shows pride in what he has done in restoring the structural integrity of many buildings. He is liberal in giving credit to others, especially to "William A. Walker, the expert diver who underpinned Winchester Cathedral singlehanded and in pitch darkness," working over five years in successive pits to place concrete for that purpose. Undertakings for which the author justly takes credit, are his many grouting enterprises, large and small, to convert disintegrated and almost ruined cathedral walls, centuries old, into monoliths, good for centuries more, once their foundations are made solid by underpinning work. That the grouting above should precede the stabilizing of the foundations is emphasized again and again.

The third section of the book while the least important, professionally considered, does give some chatty light on such diverse subjects as diving and compressed air work, explosions and other accidents, a burglary, social and war work, gardening and science. Anecdotes enliven a book which without them would still be interesting.

Some day one of our American engineering seniors will forget his racial inhibitions long enough to tell us the story of his life, and the publishers will be delightfully surprised at its entry into the best seller class.

Elaborate Study of Highway Traffic

HIGHWAY TRAFFIC IN NEW YORK AND ITS ENVIRONS: Including a Program, by Nelson P. Lewis, for a Study of All Communication Facilities within the Area—By Harold M. Lewis in Collaboration with Ernest P. Goodrich. (Engineering Series, Monograph Number One.) New York: Regional Plan of New York and Its Environs. Paper; 9x11 in.; pp. 127; 660 halftones, charts and maps; 23 tables. $2.

As a part of the extensive study being made by the Russell Sage Foundation Committee on Regional Plan of New York and Its Environs, there are being issued from time to time monographs on the different aspects of the investigations. The present one is the first of an engineering series and carries through to date the elaborate inquiry into the engineering fundamentals of traffic congestion in and around New York City that was started by the late Nelson P. Lewis and has been continued under the direction of his son, Harold M. Lewis, the author of this monograph. The book is by far the most elaborate exposition of the engineering functions relating to urban and intra-urban vehicular transportation ever published. As laid out by the senior Mr. Lewis, the studies were to include highway traffic, transit—that is, urban and suburban passenger transit—and transportation, which includes the handling and distribution of freight and passengers by rail and boat. Only the highway traffic end is discussed here.

The fundamentals of the report were outlined by Harold M. Lewis and his collaborator, E. P. Goodrich, in a paper presented about a year ago and abstracted in *Engineering News-Record*, May 29, 1924, p. 941. The present monograph extends that treatment.

The engineers have spent a number of months in traffic count and traffic analysis, in the study of motor vehicle accidents, in the study of vehicular accidents at grade crossings, in an investigation of the causes of traffic congestion, and in observation of the periodical variations of traffic on the streets. And from the data accumulated they have deduced such theoretical things as the capacity of the streets, the average length of haul

of vehicles, methods of relieving congestion and estimates of future traffic. The conclusions as stated are by no means as elaborate as the engineers have doubtless prepared in their own files. They consist in recommendations for new highways, widening of existing streets and highways, development of further bridge and tunnel connections to the city.

The value of the monograph is mainly in the accumulation of a vast amount of fundamental data. The author points out that conditions are rapidly approaching an impasse when no further traffic can be cared for and that immediate physical construction must be started if the city and its surroundings are to develop at all.

While the report is entirely on the unique problem of the metropolitan area of New York, the method of approach will be valuable for all engineers who are concerned with the study of traffic in congested areas.

Handling and Testing Bitumens

REVIEWED BY A. W. DOW
Of Dow & Smith, Chemical Engineers, New York City

BITUMINOUS SUBSTANCES: Scientific Progress of Practical Importance During the Last Fifteen Years—By Percy Edwin Spielmann, Ph.D. (Bâle), B.Sc. (London), F. I. C., Late Head of the Technical Section and Laboratory of Messrs. Highways Construction, Ltd., Co-opted Member of the Bitumen Sub-Committee of the Standardization Committee of the Institution of Petroleum Technologists. With a Foreword by J. Kewley, Member of the Council of the Institute of Petroleum Technologists. New York: D. Van Nostrand Co. Cloth; 6 x 9 in.; pp. 206; frontispiece halftone, 44 line cuts; bibliography. $4.50.

While bituminous substances have been in use for centuries, comparatively few books on the subject have been written and these have been confined almost wholly to the technical handling and testing of bitumens. The book noted above is written more as a study of bituminous substances and will be appreciated by those who are looking into the character of these materials. Great credit is due the author for the way he has handled this difficult subject. To fully appreciate the difficulties which confronted the author of this work it must be borne in mind that bitumens are materials of most complicated composition and that there are many varieties differing materially from each other in chemical constitution and physical properties. To further complicate matters, the nomenclature of the subject is hopelessly confused even in the most commonly used terms. These difficulties are appreciated by the author and the book should be read only with a full understanding of them.

After a short historical review, the author discusses the composition and origin of bituminous substances by analyzing and commenting on the theories that have been put forward by other investigators in this field. Chemical and physical tests are then discussed in a like manner, especial attention being given to the effect of heat and heating on bitumens and the change brought about in their physical properties by heat. These changes in physical properties by heat are graphically illustrated. The greater part of this work is the result of the author's own investigations.

Chemical and physical tests are then described and discussed and their relations to each other shown in graphic form. There is a little confusion in the author's description of penetrometers. He shows various penetrometers. Plate III, labeled the Dow & Griffith, is incorrect. It shows a Bowen penetrometer with a Dow & Griffith electrical clamp attached to it so as accurately to time the penetration. The penetrometer shown in plate V is really the Dow penetrometer with a mechanical clamp release devised by Rawstron.

The book ends with two appendices: A, on the Nomenclature of Bituminous Substances; B, on Standard Methods of Testing Asphalts (Institute of Petroleum Technologists, 1924—British). Where these standard methods are the same as those adopted by the American Society for Testing Materials, the author gives credit to both societies at the head of the description of the method.

The reader, if he is familiar with the subject of bitumens, may find several points in this book with which he will not agree but disagreement of ideas and the endeavor to reconcile the conclusions of different workers is most valuable in broadening one's ideas on a subject, especially one so complicated as this.

The text throughout the book is well filled with references to a Bibliography at the back of the book. This bibliography is cross-indexed with authors' names so that reference to particular authors can be found any place in the book. The volume is a valuable addition to asphalt literature and will be greatly appreciated by those who desire to go further into the subject of testing and manufacturing materials in which bitumens are used.

World Survey of Engineers and Chemists

ENGINEERS AND CHEMISTS: STATUS AND EMPLOYMENT IN INDUSTRY. Geneva, Switzerland: International Labor Office. [Studies and Reports, Series L (Professional Workers), No. 1.] Paper; 6 x 10 in.; pp. 92; tables; Geographical Index. 1s. 6d.; 30c.

The International Labor Office at Geneva, Switzerland, has among other things been studying the organization of the technical professions. It issued a tentative report in 1922 and has followed it up with the current publication, in which the attempt is made to study the conditions of life and labor of engineer and chemist throughout the world. The questionnaire method has been adopted and information has been received from 25 countries on the meanings of the terms engineer and chemist, the methods of obtaining and protecting the titles, and facilities for finding employment, the extent of unemployment, the contract of employment, the hours and conditions of work, the salaries, insurance, problems of official organization, and the general status of the profession.

This is an ambitious and worth-while program. It is to be regretted that so far as the United States is concerned the results do not appear to be very informing. Reports from foreign countries are very interesting, but they must be discounted, if the very limited reports from the United States, included in the document, are a criterion. The latter are ridiculously inadequate and at times even misinforming. The evidence is that the work was done by a European unacquainted with American conditions, which may indicate that the European reports are more reliable than those from the United States. As an instance, in the report from the United States on engineering degrees, we find this sentence: "Those (engineering degrees) of such private institutions, such as the Massachusetts Institute of Technology, are of much higher standards than those of some state universities." Which means exactly nothing.

Nevertheless, the report gives a general picture of the profession of engineering throughout the world and is useful on that account.

Sewage Problems and Practice in India

SEWAGE DISPOSAL IN INDIA AND THE EAST: A Manual of the Latest Practice Applied to Tropical Conditions—By George Bransby Williams, Vice-President of the Institute of Engineers (India); M. Inst. C. E., M. Inst. M. E.; Chief Engineer, Public Health Department of the Government of Bengal. New York: D. Van Nostrand Co.; Calcutta and Simla: Thacker, Spink & Co. Cloth; 6x9 in.; pp. 230; 37 line drawings and plates and halftones; 12 data tables. $4.

So little has yet been done in sewage treatment in "India and the East" that this book would be reduced to a few pages if all else it contains were omitted. What the author does is to review the principal methods of sewage treatment, drawing chiefly on English practice but not overlooking certain outstanding developments in Germany and America, especially the Imhoff tank and the activated-sludge process. He outlines the problems peculiar to India—notably those due to the character and habits of the population, the climate and the limited financial resources of the cities. He briefly describes most if not all of the comparatively few Indian sewage-works yet built. The book should be of service to engineers in India and perhaps elsewhere in the Far East who wish a résumé of current sewage-work practice written with what India has done, needs to do and can do always in mind. Its information on the sewage disposal practice and problems of India will be of interest and value to broad-minded engineers in other parts of the world.

Scientific Methods Applied to Patents

PATENTS: INVENTION AND METHOD—By Harold E. Potts, Chartered Patent Agent. London: The Open Court Co., Stiff paper; 5 x 7 in.; pp. 160, with index.

Six brilliant occasional essays, all "concerned with scientific method" as applied to the making and patenting of inventions are here assembled. Three first appeared in *Nature*, the *Journal of Chemical Industry* and the *Chemical Age* and three were read before the Chartered Institute of Patent Agents. The titles are: An Application of Mathematics to Law; Prediction and Invention in Chemistry; Language and Style in Patent Law; The Logical Problem of Definition in Patent Law; Scientific Method and Patent Practice; Influence of Patent on the Evolution of Research. An Introduction and an Appendix, the latter on The Work of the Patent Agent, unify the essays and add to their usefulness. The author draws freely on various sciences, on literature and art. There are citations from Samuel Butler, Darwin, Whewell, Mill, Rosseau, Flaubert, Gautier, Maupassant, H. G. Wells and others—not to give a learned or literary spirit, but by way of illustration and elucidation. The essays are well worth reading as a stimulus to thought, to the pursuit of both the scientific method and of culture even if one has no direct concern with patents or patentable inventions.

The Tax Burden and Who Should Bear It

TAXATION AND WELFARE—By Harvey Whitefield Peck, Ph.D., Associate Professor of Economics in the University of Vermont. New York: The Macmillan Co. Cloth; 5 x 8 in.; pp. 269; 3 graphical charts. $2.50.

Those who are "appalled" at the "rapidly mounting tax burden" of the country and never go further than to consider gross totals and unit tax rates would do well to read this little book. In it the author first considers the Scope of Public Expenditures and then The Distribution of the Tax Burden. The first part includes not merely data on the volume and purposes of public expenditures but also such related matters as the state in relation to individual liberty and to production, distribution and consumption. The second part takes up the meaning of justice, surtaxes and (1) entrepreneur and (2) the accumulation of capital. In the final chapter "a theory of taxable faculty" is presented.

The statistical summaries in Part I are sufficient to show trends without being burdensome. Taxes are correlated with instead of stopping short with crude per capita averages or rates on assessed valuations. The entire study, as the title indicates, is conceived in broad terms of social welfare and of social justice. A liberal view of public expenditures for the general good is taken by the author. To that end and because of the ability to pay of those who have large incomes, he favors progressive taxation, as exemplified by surtaxes on large incomes. High surtaxes, he advances theory and figures to show, will not "kill the goose that lays the golden egg," partly because money accumulation is only one of several strong incentives to business.

Rangoon River Training Works

REGULATION OF RIVERS WITHOUT EMBANKMENTS, As Applied in the Training Works at the Headwaters of the Rangoon River, Burma (Locally known as the Myitmaka Training Works)—By F. A. Leete, C. I. E., Imperial Forest Service, India; Assisted by G. C. Cheyne, Imperial Forest Service; Deputy Conservator of Forests, Myitmaka Division. London: Crosby Lockwood & Son; New York: D. Van Nostrand Co. Cloth; 8x11 in.; pp. 122; 72 halftones in 36 insert plates, 10 maps, 9 diagrams. $12.

River regulation and irrigation have been practiced in India for many years and we draw upon that practice still for a number of our so-called modern methods. This book is an elaborate exposition of one very small detail of river regulation practice. The authors are foresters and not engineers and they disclaim any detailed engineering knowledge. They were brought into the control of the Rangoon River, which is described here, because that river is one of the principal log-carrying streams of Burma. It is a heavy silt bearing river which is subject to frequent and high floods that had until the early part of this century been out of control. Engineers had about given the river up after numerous attempts at levees. The authors come to the conclusion that control could be maintained by permitting the river to build up its own bed and after a period of experiment they developed a system whereby bamboo fences were established on the channel banks which of themselves caused sand stoppage and automatically built up heavy banks that have so far retained the river except in its largest floods. Every flood tends to increase the building up of the bank and of the river bed so that the system is more or less self-maintained. The book is written in utmost detail.

Self Training for Industrial Leadership

PERSONAL LEADERSHIP IN INDUSTRY—By David R. Craig, Assistant Professor of Industry, University of Pittsburgh, and W. W. Chartres, Director, Research Bureau for Retail Training, and Dean of the Graduate School, University of Pittsburgh. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. 25. $2.50.

In the light gained by a study of how others have achieved industrial leadership the authors point the way for young men—or older ones if still young in spirit—to follow in the same path. Some of the main heads in the book are forcefulness, prestige, personal interest in one's men, leading without "bossing," teamwork, kindliness without weakness, conservation of one's energy, training subordinates and self-confidence. A self-rating card along the lines of the book is given in the last chapter, together with the good advice that some friend be called upon to check the self-rating.

PUBLICATIONS RECEIVED

PART II of the Report of the Engineering Board of Review of the Sanitary District of Chicago on the Lake Lowering Controversy and a Program of Remedial Measures, has been issued by the district trustees as a 109-p. cloth-backed pamphlet. Its special title is The Technical Bases for the Recommendations of the Board of Review. Ten appendices are to follow, taking up sewage disposal (14 chapters), regulating works, hydraulics of the Great Lakes, etc., each main topic being the work of one to seven members of the engineering board.

FORTY-EIGHT PAPERS on railway engineering read at a convention held in Germany last September have been published in the German language as a special issue of the Verein Deutscher Ingenieure under the title Eisenbahnmesser die Eisenbahntechnische Tagung und Ihre Ausstellungen, 1924. Some of the papers are by government officials and others by noted engineers. The volume contains a Bibliography of German railway literature covering a number of recent years. (Berlin, Germany: VDI—Verlag G.M.B.H. Cloth; 9x12 in.; pp. 392 + about 200 pp. of advertising; many halftones and line cuts.)

BOURNEVILLE, Bourneville Housing and the Bourneville Village Trust are the titles of three pamphlets on the English village and the famous housing schemes instituted by Cadbury Brothers. (Bourneville, England: Bourneville Village Trust.)

MANUFACTURERS and many other employers will welcome a U. S. Bureau of Labor Statistics bulletin entitled Comparison of Workmen's Compensation Laws of the United States as of Jan. 1, 1925 (10c. from Superintendent of Documents, Washington, D. C.).

ANOTHER REPORT on the Water Resources of California has been made by the Division of Engineering and Irrigation, Department of Public Works, Sacramento, Calif. The author is Paul Bailey. The pamphlet "describes an economic program of physical works for the importation of water into Tulare County."

A FORESTRY ALMANAC, compiled and published by the American Tree Association, Washington, D. C., presents in tasteful book form a variety of information on trees, forests and forestry work in the several states of the United States and other countries.

THE LATEST ADDITION to the many bulletins on Sewage Disposal for Suburban and Country Homes, as the one now before us is called, comprises the June issue of the *Virginia Health Bulletin* (State Department of Health, Richmond, Va.).

A DOZEN-PAGE SUMMARY entitled Some Preliminary Observations from a Study of Water Filtration Plants on the Ohio River, by H. W. Streeter, sanitary engineer U.S.P.H.S., has been reprinted from Public Health Reports for Jan. 30, 1925 (Washington, D. C.).

UNUSUAL IN SUBJECT and illustrative of the wide range of work being done by the United States Public Health Service is a bulletin on Biological Investigations of California Rice Fields and Attendant Waters with Reference to Mosquito Breeding, by W. C. Purdy, Plankton Expert, U.S.P.H.S. Although the studies were made in 1919 and 1920 their results have just become available. A portion of the field work was done by L. D. Mars, junior assistant saintary engineer. (20c. from Superintendent of Documents, Washington, D. C.)

STREAM POLLUTION IN ILLINOIS is dealt with in two reports issued in Bulletin 20 by the Illinois State Water Survey of which Dr. A. M. Buswell is chief. This is the first publication of Illinois River studies by the State Water Survey, previous studies being published by the Natural History Survey, thus putting chemical and bacterial data in a separate report from the biological results. One of the reports compares the results obtained during a season of low and a season of high water. A list of 57 sewage-works is given in the other report which is a survey of the sources of pollution of Illinois streams. The information as to 72 cities listed as dumping unpurified sewage into streams is not up-to-date. Evanston, Wilmette and Kenilworth sewage is noted as going into Lake Michigan, whereas for five years or more, it has been diverted into the North Shore Channel of the Sanitary District of Chicago.

METHODS OF IMPROVING the traffic conditions in the city of Atlanta, Ga., are given in a report on Plans for Local Transportation, prepared by the Beeler organization, New York City. The report recommends rerouting of surface car lines, the inauguration of bus lines, and the installation of two underground loops of moving sidewalk. It also recommends the opening of two new streets, widening of others, and the construction of two viaducts which will in effect be double-deck streets. Considerable space in the report is given to the condition of the street railway company.

TIDES AND CURRENTS in New York Harbor for 117 tide and 239 current stations have been compiled and published by the U. S. Coast & Geodetic Survey, Washington, D. C. Among other illustrations there are 13 diagrams showing the generalized tidal movement throughout the harbor for each hour of a tidal cycle. The compilation was made by H. A. Marner, assistant chief, Division of Tides and Currents.

WATER SUPPLY FOR DOMESTIC ANIMALS, a subject on which little information has been printed, is the title of a pamphlet issued by the Iowa Engineering Society (Ames, Iowa). The paper is one read before the society in January, by Hack J. Hinman, Jr., associate professor of sanitation, University of Iowa, and chief of the water laboratories of the Ohio State Board of Health. The author favors as high a standard of water for domestic animals as for human beings and considers it advisable (perhaps for conditions in his part of the country) to provide animals with ground rather than surface water.

New Books and Revised Editions

[Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.]

CANADA'S GREAT HIGHWAY: From the First Stake to the Last Spike—By J. H. E. Secretan. London: John Lane. Cloth; 5x8 in.; pp. 252; 16 halftones. 7s. 6d.

THE EFFECTS OF IONS IN COLLOIDAL SYSTEMS—By Dr. Leonor Michaelis, University of Berlin, at present Professor of Biochemistry at the Aichi Medical University in Nagoya, Japan. Baltimore, Md.: Williams & Wilkins Co. Cloth; 5 x 8 in.; pp. 108; 7 line cuts. $2.50.

FORTSCHRITTE DER ABWASSERREINIGUNG—Von Dr.-Ing. K. Imhoff. Berlin: Carl Heymanns. Boards; 6x9 in.; pp. 112; 69 halftones and line cuts.

MUNICIPAL BUDGETS AND BUDGET MAKING—By A. E. Buck. National Institute of Public Administration, New York Bureau of Municipal Research. New York: National Municipal League. [National Municipal League Monograph Series.] Boards; 6x9 in.; pp. 77. $1.50.

PORT DEVELOPMENT—By Roy S. MacElwee, Ph.D., Commissioner of Port Development, Charleston, S. C., Major, S. S., O. R. C., etc.; Former Director, U. S. Bureau of Foreign and Domestic Commerce. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. 456; 157 halftones and line cuts. $5.

A SHORT HISTORY OF AMERICAN RAILWAYS, Covering Ten Decades—By Slason Thompson. Chicago: Bureau of Railway News & Statistics. Cloth; 6x9 in.; pp. 473; halftones and sketches; index. $2.

STRENGTH OF MATERIALS—By Edward R. Maurer and Morton O. Withey, Professors of Mechanics in the University of Wisconsin. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. 382; many detail line drawings; 16 tables. $3.50.

TASCHENBUCH DER STADTENTWÄSSERUNG (Taschenbuch für Kanalisationsingenieure)—Von Dr.-Ing. Karl Imhoff. München and Berlin: R. Oldenburg. Cloth; 5x7 in.; pp. 90; 10 line drawings, 15 plates; index.

TESTS FOR RAILWAY MATERIAL AND EQUIPMENT—By Henry Knauer, M. A. S. M. E. [Railwaymen's Handbook Series.] New York: Simmons-Boardman Publishing Co. Flexible; 5x8 in.; pp. 257; 31 line cuts and halftones. $3.

VAUBAN: BUILDER OF FORTRESSES—By Daniel Halévy. Translated with notes by Major C. J. C. Street, O. B. E., M. C. New York: The Dial Press. Cloth; 6x8 in.; pp. 256; frontispiece. $2.75.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Continuous or Discontinuous Floor Slabs For Bridges

Sir—It appears to be customary in the design of bridges to build concrete floor slabs continuous over stringer or girder supports. This construction when analyzed, taking into consideration the flexure of the stringers or girders under heavy wheel loads, develops conditions that should prohibit its use.

When the wheel load is between the supports the negative moment over the supports will develop tension cracks, which will be in compression when the load is over the support and the moment becomes positive. Have any experiments been made with beams thus subject to alternate negative and positive moments? It seems that a brittle material like concrete would soon be destroyed under such conditions, and that it would be better to design the slab as simple beams from stringer to stringer, with no reinforcing at the top. This would probably result in only one crack over the support, instead of many as will be the case if reinforcing is used at the top.

I find in the case of a 120-ft. truss with 20-ft. roadway that the cost of the simple spans will be less than that of continuous spans and the difference will be more than enough to offset the additional cost of the additional steel required to carry the increased dead-load.

J. L. ALBERS,
Structural Engineer, Tennessee Department of Highways.

Nashville, Tenn.,
May 6, 1925.

In Defense of the Young Engineer

Sir—Referring to Mr. Kirkpatrick's letter in your issue of April 23, p. 701, where he says: "A combined outlet sewer figured out as requiring an area of 6 ft. by 6 ft. Later, it developed that more advantage would be had from two outlets, in different places. The college-bred engineer built them each 3 ft. by 3 ft. He had received good grades in mathematics, too."

This story is so inherently improbable that it would have been well either to have given full particulars, including references to at least three trustworthy witnesses or otherwise to have omitted it. This has certainly nothing at all to do with mathematics and when it is cited as a typical example of the mentality of American college-bred engineers, one can only feel sorry for the gentleman who takes the trouble to cite it.

Mr. Kirkpatrick also says: "It is not an accident that scholarship scores high and higher and the executive ability 'to do the job' scores higher, among recent graduates from West Point and Annapolis than from civilian schools." I would like to ask Mr. Kirkpatrick for some specific details to justify his statement that it is not an accident, and would also like to know how this "ability to do the job" was measured. Some of the "executive ability" I have met with in my own experience has consisted largely in letting the other fellow do the work and then brazenly claiming credit for it. Also some of the gentlemen with executive ability to do the job, with whom I have come in contact, could do the job only when unlimited means were at their disposal. That is no doubt creditable for a military man, but has but very little value in civil life, where cost enters in as the most essential feature.

If I have understood Mr. Kirkpatrick correctly, he would hold that a great mathematician is necessarily a better teacher of mathematics than a lesser mathematician, to take an example. That may be true when very advanced mathematics is involved, but I believe it is not true when ordinary elementary calculus is to be taught and it is no doubt the same in other branches.

B. F. JAKOBSEN.

Los Angeles, Calif.,
May 1, 1925.

Quick Hardening Not Quick Setting

Sir—In the April 30 issue of *Engineering News-Record*, on p. 741, you state that the "Use of quick setting cement allows early completion of Maryland bridge."

I draw your attention to the fact that the alumina cement used on this work is not a quick setting cement. It is a slow setting cement attaining its set in about the same length of time as does portland cement. It is a rapid hardening cement developing at 24 hours a strength considerably greater than that required for portland cement 28 days.

This distinction in the use of the terms "quick setting" and "quick hardening" is not as fine as it may seem to some and I am writing to ask your co-operation in the use of these terms. To call alumina cement quick setting is misleading and apt to increase the misunderstanding held by some as to its properties. There have been a number of cases where purchasers of our cement have used this material under the impression that it would attain its set in a few minutes. They have been misled by the use of the term "quick setting" when "quick hardening" was meant.

THE ATLAS LUMNITE CEMENT CO.,
By JOSHUA L. MILLER.

New York,
May 9, 1925.

Not So Black as They Are Painted

Sir—Almost everyone who has taught engineering realizes that there is need for improvement in the methods of teaching and in the material taught. Every progressive teacher in engineering, and there are some, earnestly seeks constructive criticism, advice and assistance from practising engineers. We would like these suggestions in short, clear, concise words in order that we can understand them. So often they come hidden in a maze of unintelligible, lengthy phrases without a single workable idea. This much to admit the necessity of changes and to express willingness to accept ideas from practising engineers.

Immediately after reading R. Z. Kirkpatrick's letter in *Engineering News-Record* of April 23, 1925, p. 701, I asked a class of 15 sophomore embryo civil engineers, who could not have had an opportunity to read the letter previously, the following questions: (1) Will a 4 x 4-in. fir timber with a span of 6 ft. sustain your weight? (2) A sewer outlet was designed to be 6 x 6 ft. Later it was found more advantageous to use two outlets instead of the one as designed. Would two 3 x 3-ft. outlets be acceptable? (3) A Mississippi River levee was being built by means of a dragline. How close to the actual grade line should grade stakes be set for the dragline operator?

Written answers were handed to me at the end of 10 minutes. It may be astonishing to learn that these engineers (?) were agreed that the timber would carry them safely across the span; that the two outlets would not carry the same amount of sewage as the one; and, that they would set grade not closer than the nearest 0.01 ft. (Answers to the third question varied from 1.00 ft. to 0.01 ft., with an average of 0.53 ft. for the class.) To this class, the above questions were purely judgment questions, since they have not thus far in their school work been burdened with hazy ideas of bending moment formulas, and their mental activities are not hampered by the knowledge of the existence of a hydraulic radius. Am I to conclude that this class is above the average, or did Mr. Kirkpatrick just happen to have weak assistants and accidently has been thrown in contact with poorly prepared engineers who have mathematical dyspepsia?

The third question is based upon the instructions to set grade to the nearest 0.001 ft., issued by a successful consulting engineer to a youngster who was sent 200 miles from the office to set stakes for the levee. The stakes were set to the nearest 0.10 ft. I'll rest my case with the readers and let them decide who exercised the greater judgment, the consulting engineer or the young college man.

A certain commission that supervises the placing of thousands of yards of concrete yearly is paying recent college graduates a fair salary to count the revolutions of the drum of the mixer. They are not instructed to pay any attention to the amount of water used in mixing, the gradation of the aggregates, or the cleanliness of the water or aggregates. Those of your readers who know the factors affecting the strength of concrete judge whether the chief engineer who must draw a salary of $12,000 is exercising a great deal of judgment.

A consulting engineer estimated the time required to complete a certain engineering job to be 3 months. The opinion of two teachers was asked. They carefully considered the problem and answered 8 months. These teachers represent the "adolescence and obsolescence" that Mr. Kirkpatrick mentions. The contractor agreed to do the work in 90 days. When the work was actually completed it was found that 8 months were required, minus a very few days, and the contractor lost less than 15 days due to weather conditions.

I am not condemning the practising engineers as a whole; 99 per cent of those I know personally are of the very highest type of men, and are good, sound, stable thinkers. A few are the poorest excuse for an engineer. Our colleges are sheltering some old fogies, but their colleagues are among the foremost engineers of the world and they are giving their life in an effort to make engineering problems more simple and to increase the stock of information on every subject studied by man.

Let us not condemn a class because of the actions of a few. Let him who does not believe the engineering teacher has a job as big, problems as elusive, and work as difficult as that of the practical engineer, take a vacation for a month, go to the nearest engineering college and ask to teach some of his favorite subjects. He will find the teachers will welcome his coming. Perhaps he will find his memory has deceived him, and has carried his idea of teaching engineering falsely for many years, or perhaps times have changed and improvements have been made.

The teachers urge the engineer's co-operation, seek his counsel, and ask his constructive criticism.

Stillwater, Okla., May 2, 1925. J. E. JEWETT, Instructor of Civil Engineering, Oklahoma A. & M. College.

Preventing Dam Undercutting

Sir—I have read with great interest the article by Adolph F. Meyer in *Engineering News-Record*, April 9, 1925, p. 597. Mr. Meyer is to be congratulated on a clear statement of an important engineering problem.

It seems to the writer that the procedure suggested at the bottom of p. 597, that "In most cases, the hole which the water gouged out, if perpetuated and limited with lining material, would have served as a far better and less expensive barrier to the destruction of the dam," would be the logical solution of many, if not all, troubles from undercutting existing dams, and that its equivalent, installed when the dam is built, would be an easy method of preventing erosion.

When an overall dam is located on an erodible river bed the apron serves two distinct purposes: (a) To prevent undercutting at the toe of the dam, and thus decreasing the overturning resistance; (b) to reduce percolation under the dam to a safe amount by increasing the length of the percolation path.

The second purpose is as important as the first and is especially important where the bottom is of such a nature that it is difficult to install a tight diaphragm at the upstream toe of the dam.

In the method proposed by Mr. Meyer the bucket would have to be very deep in case of a high overfall (as in his Fig. 9) if it is intended that the entire force of the falling sheet be absorbed by the resistance of the water held in the bucket, otherwise the bucket will be very heavy to take the wear of the falling water and débris.

In case the downstream face of the dam is undercut as shown in Figs. 5, 7, 8 and 9 in Mr. Meyer's article, there is serious danger of cavitation and consequent erosion of the concrete unless suitable provision is made for a generous supply of air into the space under the falling sheet of water.

Taken as a whole, the method outlined by Mr. Meyer when applied with good engineering discretion should result in a safe solution of some very difficult overfall problems.

New York City, May 5, 1925. GEORGE W. JEFFERY.

Sir—I have read with interest the article by A. F. Meyer in *Engineering News-Record*, April 9, p. 597. I agree with him that it is dangerous to design the base of a dam with a rounded section which gives to the water a horizontal speed capable of undermining the downstream apron of the dam. It might be interesting for readers of *Engineering News-Record* to know how, in France, the form of dams is generally determined.

Supposing that the water upstream from the dam has no calculated flow. Its velocity at the dam is then $v = \sqrt{2ga}$, with the condition that $a = 2b/3$.

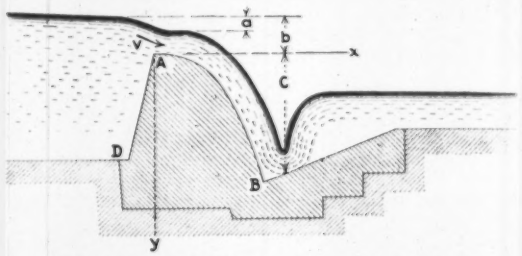
In falling, the water takes the form of a parabola. As it is advantageous both as a matter of resistance and expense to enlarge the dam by battering the downstream face, one is led to adopt, for the form of the downstream face of this dam between A and B (see the accompanying figure) the same form as the liquid vein, that is to say the parabola which it describes. Thus, there is imparted to the water only the horizontal speed that it would have if the dam were merely a vertical wall.

The parabola is calculated easily through its relation to a system of rectangular co-ordinates with the origin at A:

$$x = vt = t\sqrt{4gb/3}$$
$$y = \tfrac{1}{2}gt^2 = (3gx^2/8gb)$$
$$8by = 3x^2$$

If the value of C is large, this equation leads to a resultant outside the safe area of the base and it is necessary to thicken the base by giving the upstream face a certain batter. This is indicated in the figure by AD.

If the water upstream from the dam has a calculated velocity as is the case in a dam built across a river, the above calculation should be modified simply by the application of Bernouilli's theorem.



SPILLWAY PROFILE AS USED IN FRANCE

With the calculation based on the hypothesis of maximum flow of the dam, it is assured that water will not fall beyond the foot of the dam and that it will have the minimum horizontal velocity. It thus becomes easy to reinforce the apron of the dam at that spot where the water falls and to create there a mattress of water to absorb a certain fraction of its kinetic energy in such a fashion as to obtain at the outside edge of the apron a regular and tranquil flow without any tendency to scour. The dams which I have built on this model fully confirm the anticipations of the theory.

M. SUQUET, Engineer in Chief, Ponts et Chaussées.

Paris, France, April 24, 1925.

Motor Car Cost on Survey Work

Sir—Recently we were assisted by data published in your Job and Office section on the cost of operating a Ford car. It may interest you to publish figures from our books on the cost of operating a Ford touring car from May, 1920, to Jan. 1, 1925. This car was used by our survey corps, being driven by various drivers and receiving very ordinary care. After it had served what seemed to be its full life, it was sold and the depreciation represented the actual cost to us. Its cost new in May, 1920, was $810.39, and it was sold for $35, making the actual cost $775.39.

Our system of records are such that we feel sure that we have included every item of cost in the following:

	Cost per Mile
Gasoline	$0.0266
Oil	.0037
Grease	.0002
Auto repairs	.0256
Tires and tire repairs	.0133
Garage	.0199
Miscellaneous, including insurance	.0144
Depreciation	.0331
Total	$0.1368

Total mileage	23,413 miles
Miles per calendar day	14.39 miles
Miles per gallon of gasoline	10.42 miles
Average price per gallon	$0.2771

Pittsburgh, Pa., May 1, 1925. WILLIAM A. WELDIN, Blum, Weldin & Co.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Emergency Garbage Disposal for St. Louis, Mo.

A lower court decision, now on appeal, and a change in administration have thrown into uncertainty the contract for the disposal of such of the garbage of St. Louis, Mo., as is not incinerated. Pending a final decision on the legality of the five-year contract, bids for a one-year temporary contract wer invited and an award recommended. Meanwhile service is being continued under the 1924-25 contract.

Almost immediately after the award on April 17 of a five-year garbage collection and disposal contract by the St. Louis Board of Public Service to Charles L. Rea, of Kansas City, Mo., the Jefferson Distributing Co., of St. Louis, a rival bidder and holder of the contract for the year 1924-25, obtained a temporary restraining order to prevent the execution of the contract. The Rea bid on March 24 was at the rate of 74c. a ton, the Jefferson bid was $1.29, the highest of the five bids received, while the lowest bidder, Thomas L. Faudree, St. Louis, offered to do the work for 69c. a ton. All five of the bidders planned to dispose of the garbage by feeding it to hogs. Mr. Rea, who manufactures a hog cholera serum, selected Establishment Island, about 48 miles south of St. Louis, as his hog-feeding grounds. On the basis of the estimated amount of garbage for 1925-26, the total bids ranged from about $55,000 to about $102,000 a year, with increases according to the amount of garbage collected in subsequent years. The city was to deliver the garbage at the foot of Chouteau Ave., from which it was to be moved to the disposal site by boat.

When proposals for a one-year emergency contract were invited, three of the five March 24 bidders offered to do the work at material reductions from their bids on the five-year contract. The Jefferson Company reduced its bid from $1.29 to 24c. a ton; Foudree from 69 to 47c.; Rea from 74 to 68c. The new mayor is reported to be favorable to executing the proposed emergency contract with the Jefferson Company. The Jefferson contract for 1924-25 was held at $1.03 a ton, a reduction from $1.95 obtained by a second request for bids a year ago (see *Engineering News-Record*, March 6, 1924, p. 421).

St. Lawrence Board Studies Ice Problems

One of the important studies which the St. Lawrence engineering board is undertaking deals with the ice problem. The examinations of materials now in progress will include reports on bottom and bank materials at points where it may be found advisable to slacken the velocity so as to make it possible for the ice cover to form. This can be accomplished at various points by widening the channel if the operation is faced with no unusual difficulties. On account of low banks at several points it would be impossible to accomplish the result simply by raising the water.

One of the difficulties of operating hydro plants in regions where low temperatures prevail is the formation of frazil ice in mushy form, which is drawn under surface ice and forms hanging dams. This causes flooding above and diminishes the power capacity below.

Engineering Fifty Years Ago

From *Engineering News*, May, 1875

Hints on Practical Surveying

* * * *

THE first and most important lesson that a young Surveyor must learn is that he must *always* be at the *front*. He must do all the thinking, most of the walking, and a great deal of the downright hard drudging such as carrying and driving stakes, chopping, setting ranges, etc., etc., if he would make time and money. He should always "lead" in chaining and in cutting out a line will spend his time in keeping his axemen close to the line and always at work, rather than indulging in vociferous gesticulations behind his transit, and indolently awaiting the random and deliberate movements of untrained and uninterested assistants. The average Surveyor's assistant is not to be trusted in matters of measurement and judgment, and it is not until students have commenced practice for themselves that they take the necessary interest in their duties to ensure such uniform accuracy as to entitle them to be always relied upon.

To Designate U. S. Highways

Highway officials of 11 Western States met at San Francisco May 15 to designate the important interstate roads in 11 States to be uniformly marked as United States highways. The meeting was the outcome of the initial conference of the Joint Board on Interstate Highways, composed of State and Federal highway officials, held at Washington April 20 and 21. It was the first of a series of regional meetings to be held during May and June at San Francisco, Kansas City, Chicago, Atlanta, New York, and Boston for the purpose of selecting the important interstate roads to be known as United States highways.

Major Edgerton to Be Made Chief Engineer of Power Commission

Major Glenn E. Edgerton is to succeed Col. William Kelly as chief engineer of the Federal Power Commission. For the past nine months Major Edgerton has been assistant chief engineer for the commission.

Major Edgerton's most important engineering work was in connection with the development of the highway system in Alaska where he served as chief engineer for the Alaska Road Commission for 5 years. During the war Major Edgerton first was in charge of the training of engineer regiments and later was division engineer for the 14th Division. After the war he was director of sales for two years.

As a scholar, Major Edgerton has attained unusual distinction. He stood at the head of the class of 1908 at the United States Military Academy and is an honor graduate of the General Staff School. Prior to entering West Point he had an engineering degree from the Agricultural College at Kansas.

Major Edgerton saw two years of service in the construction of the Panama Canal; was district engineer for the military area at El Paso; and was district engineer of the Jacksonville-Florida River and Harbor District.

Work to Start on Series of Power Plants on Feather River

Construction is to start shortly on a series of hydro-electric developments on the Feather River in California by Feather River Power Co. of San Francisco according to an announcement by Lars Jorgensen, consulting engineer of that city, who has prepared the plans. Work to be done at the outset includes only the first plant of the series which ultimately will have a capacity of 415,000 hp.

Buck's Creek plant, the first to be built, is to have two 30,000-hp. units operating under a head of 2,480 ft. The next two plants, each to have three 30,000-hp. units, will be at Dean Creek and at the Nelson Point-Sherman Bar site, respectively. Later developments are programmed further along the stream with capacities ranging from 15,000 to 120,000 hp. Although complete field studies have been made, final decision as to exact location and capacity of each successive plant is reserved so that each development may be laid out to make the most of conditions obtaining when its turn comes.

Financing of the first project, it has been announced, has been completed and construction will start as soon as rights-of-way and water-rights questions are settled.

It is announced that power from the new development is to be sold to the Great Western Power Co. and that R. C. Storrie & Co. will do the construction work on the project.

Fire Protection Convention Covers Wide Field

Building Construction and Fire Equipment—Sprinklers and Pumps—Record Attendance

Several phases of safe construction and equipment of buildings to insure fire prevention and protection were included in the varied subjects presented at the annual meeting of the National Fire Protection Association, held in Chicago on May 12 to 14. Requirements for exit stairway towers, enclosed stairways and exits for hospitals and institutions were submitted, the last including a formula for exit capacity in relation to the number of persons on each floor.

For openings in fire-resistance walls exposed to fire from adjacent buildings, a report submitted varying degrees of protection based on the relations of the exposed and exposing structures. Such protection may include automatic rolling shutters, swinging shutters, wired-glass windows and outside sprinklers; this last method, however, often encounters difficulties of both a practical and an engineering nature. For protection of records, specifications have been prepared covering vault and vault door construction. Other specifications dealt with construction and equipment of residences and the carhouses of electric railways.

Since centrifugal booster pumps are coming into use to give the pressure required for sprinkler service where the pressure in the public water supply system is inadequate for the purpose, regulations for booster pump installations were submitted. Amendments to sprinkler regulations included revision of the section on alarm valves, in view of objections that have been raised. Minor changes were made also in the specifications for gate valves, check valves and indicator posts. In continuation of the study of dust explosions, regulations were submitted for the prevention of such explosions in starch factories; also for pulverized fuel systems and for blower systems for heating, ventilating and the conveyance of material.

A registered attendance of nearly 500 broke all records. Except for an afternoon spent at the Underwriters' Laboratories the proceedings consisted entirely of six business sessions, no entertainments being featured. For president, Rudolph, P. Miller, New York, was re-elected, with Dana Pierce, Chicago, and Allen M. Schoen, Atlanta, Ga., as vice-presidents; secretary, Franklin H. Wentworth, Boston, Mass.

Biographical Data Wanted

It is intended to undertake a life of the late Dr. W. H. Maw, engineer and scientist, and for so many years editor of *Engineering*, London. Those of his personal friends, colleagues or correspondents who may have interesting material, especially in the shape of personal reminiscences or letters, to contribute, are requested to communicate with W. E. Simnett, c/o the Institution of Civil Engineers, Great George St., London, S. W. 1.

WASHINGTON NOTES

Col. William Kelly, who has resigned as chief engineer of the Federal Power Commission and retired from the Army to become director of engineering for the National Electric Light Association, will continue to serve as a member of the Joint Engineering Board for the St. Lawrence River.

In his capacity as acting chairman of the Federal Power Commission, Secretary Work has increased the salary of O. C. Merrill, the commission's executive secretary, from $6,000 to $7,500. Because of the limitation carried in the appropriation acts that become operative July 1, it will be necessary to reduce the salary to $6,500 after that date.

The salary allowed the executive secretary of the Federal Power Commission has been one of the unsatisfactory features of the act. As a recognition of the service performed by Mr. Merrill during the ten years that the act was being formulated, the salary was fixed at $7,500. This was somewhat higher than comparable salaries in effect at that time, but it was felt by the framers of the act that this would be a well deserved reward for Mr. Merrill, who was slated for the position of executive secretary. Just as the finishing touches were being put on the bill, some arbitrariness developed in the conference committee and when delay would have meant the failure of the legislation a reduction of the salary to $5,000 was brought about.

Pay was continued at that rate until the reclassification act became effective last July 1. An increase to $6,000 then was possible. Prompted by the announcement of Mr. Merrill's intention to leave the government service, Secretary Work recently gave the matter consideration and found that Mr. Merrill was eligible for an increase under the new act. This was allowed at once and made retroactive in so far as it was possible.

While Mr. Merrill states that he is highly appreciative of this recognition, it will not alter his determination to take a vacation and look for a job where the remuneration is likely to be more nearly commensurate with his experience.

The Department of State should interest itself formally in the questions involved in the proposed development of a power project in the St. Johns River by the Province of New Brunswick. Opinions to the foregoing fact are reaching Washington from persons thoroughly conversant with the project. At present the State of Maine is the only interest which has concerned itself with American equities in this development. The feeling is that the individual states are scarcely competent to represent the country, as a whole, which is interested in the development of international streams.

The Province of New Brunswick is planning a hydro commission along the line of that in Ontario. While the site which it is proposed to develop is not in the international section of the St. Johns River, it is at a point only a few miles distant from the point where the stream leaves the international boundary and the improvement will raise the water level in the international section.

It is believed that conditions should be laid down in advance which will insure the return to the United States of its share of the power without the payment of export duties.

Construction work at Muscle Shoals has reached the cleaning up state. The masonry work of the dam, the lock, and the power house have been completed with the exception of a small amount of work around some of the water wheels and the switch house. The main spillway gates have been installed and the machinery for their operation is practically ready. The work still to do is in connection with the installation of the lock gates, the switch board, and the switching apparatus. The latter two pieces of work are under contract so that the organization of the corps of engineers is being demobilized rapidly.

Detroit Bridge Project Again Under Discussion

Preliminary steps to revive the project for an international bridge across the Detroit River connecting Detroit, Mich. and Windsor, Ont., have been taken by officials of Detroit and the border cities. Mayor John W. Smith of Detroit has been named chairman of a committee to investigate the engineering and financial problems of the project; Mayor Frank J. Mitchell of Windsor was appointed vice-chairman and M. E. Brian, city engineer of Windsor, secretary. Such a project was under discussion in 1921, but the attempted private-enterprise financing did not succeed.

It is estimated that approximately 1,000,000 automobiles and 10,000,000 passengers cross the river annually, and that the tolls collected would be sufficient revenue to meet sinking fund requirements to retire the bonds issued to finance the construction cost. Mayor Mitchell expressed the belief that such a bridge would never be built by private capital, and it was proposed that the possibility be investigated of the interested municipalities issuing bonds which would be redeemed from the earnings.

Great Northern Ry. to Electrify 30 Miles in Cascades

The Great Northern Railway Co. is reported to have completed plans for the electrification of about 30 miles of its line through the Cascade Mountains, including the complete electrification of a tunnel 14,000 ft. long. At the present time eastbound trains are handled through this tunnel by electric locomotives and westbound trains are allowed to drift through the tunnel without working steam, the westbound movement being all down grade through the tunnel.

Illinois Sanitary Trustees Hold Live Meeting

All but one of the twelve sanitary districts in Illinois were represented at the second annual meeting of the Illinois Association of Sanitary District Trustees, held at Decatur, Ill., on May 5 and 6. Those present included 23 trustees, 15 engineers and attorneys and a few guests. At the inspection trip to the Decatur sewage-works much interest was displayed over the experimental plant, which comprises a partial aeration of the sewage between the Imhoff tanks and the sprinkling filters.

As to present conditions, a paper by S. A. Greeley explained that five of the twelve districts have works in operation, one plant is under construction and a seventh will be commenced soon. River pollution in Illinois was reviewed by A. M. Buswell, who stated that pollution by industrial waste is the subject of special study by the State Water Survey, including tests of the behavior of Imhoff tanks. Discussion, which was active, related chiefly to operating experiences, pumping costs, handling gas-works wastes, infiltration, the Decatur oil-trap ordinance and the percentage of treatment costs that should be paid by industrial establishments.

Smoke Prevention Meeting

Various aspects of the municipal smoke nuisance and smoke prevention problem will be presented at the annual convention of the Smoke Prevention Association, to be held at the Pantlind Hotel, Grend Rapids, Mich., on June 17 to 20. A special subject will be the relation of oil-burning furnaces and devices to the elimination and abatement of smoke, while one day of the meeting will be assigned to representatives of the railroads. H. B. Meller, chief of the smoke regulation bureau at Pittsburgh, is president of the association; secretary, Frank A. Chambers, chief smoke inspector, Chicago.

Association to Promote Garden Cities Proposed

As the result of a luncheon conference given under the auspices of the Regional Plan of New York and Its Environs on May 15, a committee was appointed to arrange for the organization next fall of an American garden city association. Among the members of the committee are Richard S. Childs, National Municipal League, 261 Broadway, New York City, and Henry James, of the Regional Plan of New York and Its Environs 130 East 122nd St., New York City.

Certain Cities in Pennsylvania May Charge for Sewer Use

Governor Pinchot has signed a bill authorizing third-class cities in Pennsylvania to charge property owners for the use of sewers where sewerage systems or disposal works have been bought or built at public cost. The charges must be fixed by ordinance.

Six States Approved New Colorado River Pact

As reported April 2, p. 574, the failure of Arizona to ratify the seven-state Colorado River compact of 1922 led recently to a proposal that a new compact, identical with the 1922 compact but limited to six states (Colorado, Utah, New Mexico, Wyoming, Nevada and California) be adopted. This plan has been considered by these several states and one by one all have ratified the Six-State compact. California, however, added the proviso that the agreement would be binding only if the U. S. govrenment erects a storage dam of 1,000,000 acre-ft. capacity at or near Boulder Canyon. The other five states did not qualify their approval. This action by the California Legislature, it is believed, nullifies ratification by that state of the original compact, approved two years ago.

This attention to a six-state compact appears to have stimulated action in the Arizona Legislature and the original Seven-State Compact was again brought before that legislature in March, this time with a proviso attached to make it binding upon Arizona only in case California and Nevada agree to a division of water between these three states on prescribed terms. The Arizona Assembly and Senate both passed this measure only to have it vetoed by Gov. Hunt.

The Arizona action plus the proviso written into the California approval of the Six-State pact leaves the whole situation in a more uncertain and unsettled state than before.

Tenth Anniversary of Engineering Foundation Celebrated

The regular meeting of Engineering Foundation held on May 14, being the tenth anniversary of the first meeting of Engineering Foundation Board, it was made the occasion of a dinner to Ambrose E. Swasey, tendered by the trustees and officers of United Engineering Society, the directors, presidents of the Founder Societies and the members and officers of the Foundation Board.

Following the dinner testimonials of their service to the Foundation were presented to Charles F. Rand and Mr. Swasey, and Dr. Frank B. Jewett described with the aid of motion pictures the application of "permalloy" a newly-developed magnetic alloy to the manufacturer of submarine cables. J. V. W. Reynders addressed Mr. Swasey on behalf of the Founder Societies and Edward Dean Adams presided.

Steelwork of Philadelphia-Camden Bridge Erected Across River

Closure of the stiffening trusses of the main span of the Philadelphia-Camden bridge over the Delaware River was accomplished on May 7, 1925, when the central chord section of the two trusses were erected. The north truss was closed first. The steelwork, which has been erected with all splices bolted to permit adjustment of the trusses to dead load position before riveting, hung from the cables so that the central opening was within four inches of the required length, and the closing section was easily entered by jacking apart of the chords. On the south truss the closing chord section fitted exactly without jacking of the steelwork.

Erection of the trusses and floor system is handled by four travellers. The general scheme of erection comprises four movements of these travelers. On the first pass the bottom chords and verticals of the trusses, and the floor-beams and cross-bracing are erected. On the second pass, which is a return of the travellers to the towers, the diagonals are erected. The third pass secures erection of the top chord and on the final return of the travellers to the towers, the floor system and miscellaneous steelwork of the footwalks and tracks are erected. The travellers are equipped with electrically operated hoisting engines and each traveller has two 70-ft. booms. They move along the bridge spans on standard 85 lb. rails laid on ties on the steel of the bridge floor.

Erection of the trusses was commenced on March 3. The steel for the two side spans is not entirely out of the shop. Erection of the side spans is about 40 per cent complete.

Association Plans to Encourage Land Settlement

Organization of the Farm Communities Association has just been effected, with Alvin Johnson, of New York, as chairman of its executive committee. The organization intends to encourage selected settlement of land in the South, with financial and agricultural aid. The undertaking means much for land settlement, in the opinion of Dr. Elwood Mead, Commissioner of Reclamation. It means that the settlement of the wet, cutover and abandoned lands in the South, at the inception of the federal government's interest in the matter will be put on a business-like basis. In some sections of the South, in particular, there has been a tendency to replace the drift away from the farm with foreigners who are not capable of rising above an adobe hut or with shanty types of native born. Means must be found, Dr. Mead believes, of making farms in the South attractive to the better elements of our citizenry and to immigrants who are capable of absorbing our culture and adapting themselves to our modes of living.

It is pointed out that haphazard colonization results in great waste of human material. In one case described at the organization meeting a hard-working farmer from New York sold his improved farm and migrated with the idea of improving lower priced land. Settled in the new region, where they had no guidance as to the best methods of agriculture to pursue, the family applied New York methods and complete failure followed. His financial wreck embittered the father and instead of an asset the community might have had he became a liability. The sons and daughters were forced to hunt work in the towns and on the railroad, so agriculture lost several individuals who would have been valuable to any farm community. This case contrasts with another, where a family had the guidance offered by an organized farm community. The father prospered in his new location because he was saved from the mistakes he naturally would have made if left to his own devices. Care was exercised to see that he did not pay too much for his land or that he did not take more land than he could handle to advantage. His sons grew up and bought nearby farms and they prospered. The family was saved to agriculture and the community benefited materially. It is the multiplication of such instances that is paving the way toward national well being or toward national disaster, Dr. Mead asserts.

Government Engineers Promoted

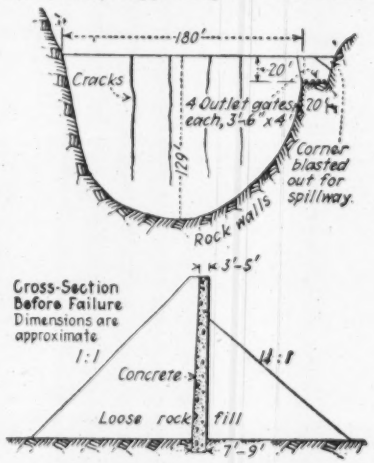
By a regrouping under the Reclassification Act some 400 of the employees of the Corps of Engineers will receive substantial increases in pay. The greater portion of the increase goes to assistant engineers, junior engineers, superintendents, draftsmen and chief clerks. These promotions are intended to adjust to some extent the subnormal level of salaries which the technical and more experienced personnel of the Corps has been receiving.

Bully Creek Dam Failure Due to Unsupported Core-Walls

Special Correspondence

Failure of the uncompleted irrigation dam of Bully Creek in eastern Oregon, reported in *Engineering News-Record*, Feb. 19, p. 332, resulted in the complete destruction of the dam, the core-wall shearing off within from 5 to 10 ft. of the rock walls along its entire perimeter. It has been impossible to obtain copies of the plans from which the dam was built, but measurements taken on the ground indicate that the dam at the time work upon it was abandoned about 1913 was about in the condition shown in the drawing.

The dam was built to store some 10,000 sec.ft. above the outlet gate, 6,000 acre-ft. remaining in the bottom as dead water. The general opinions seems to be that it was originally intended to have it consist simply of the concrete structure shown as the core-wall in the accompanying sketch. This was built of an excellent concrete, reinforced with 24- and 60-lb. railroad rails. It was built without any supporting fill and without



ELEVATION AND CROSS-SECTION, BULLY CREEK DAM

a bypass to handle flood water during constructing. The first freshet to which it was subjected cracked it badly and bulged the central portion downstream. After this accident the rock filling was placed above and below the dam, which filling was carried to the height shown in the sketch at the time failure occurred. This left about 35 ft. of the core-well unsupported on the downstream side.

The dam was condemned in 1913 and an attempt was made to destroy it or at least enlarge the overflow by shooting away a portion of the core-wall above the outlet gates. At the time of the failure ice blocked the outlet gate and caused the flood to overtop the structure. Apparently, the failure was almost instantaneous as the whole structure was swept away and spread out for a considerable distance down the valley and a wave of water 45 ft. deep swept down the valley for several miles. It appears from local reports that the dam was overtopped during floods in previous years and consequently no warning was given to people in the valley below the dam.

Random Lines

The Ad-Man is Above Natural Law

Follows an extract from the advertising circular of the Hart & Cooley Co., who make hot-air registers. A. L. S., who sends the circular in, suggests that the "advertising exsquirt" who wrote the copy would probably advocate saving the cost of high pressure fire systems by using larger nozzles with existing pressures, so as to reach the tops of higher buildings. Another engineer suggests that, unknown to the oarsman, there is a spouting whale beneath his boat.

IF YOU were out on a lake in a boat with a hole one inch in diameter in the bottom of that boat, there would be no question in your mind as to the capacity of that hole to admit water. Neither would there be any question in your mind that a hole twice as large would admit twice as much water.

The same idea applies to air through a register. The larger the hole or more "free air capacity" there is, so much greater will be the amount of warm air admitted into a room.

Versatility

Don Marquis, the columnist of the New York *Herald-Tribune*, gives the following publicity to a fellow professional:

R. I. P. forwards to us the business card of Otis Scripter, of Zion, Ill.:

Doctor of Sanitary Science.
Doctor of Philosophy.
Doctor of Divinity.
Graduate of three leading schools of Embalming.
Registered Embalmer.
Graduate Exterminating Engineer.
Member of the Exterminating Engineers of America.
Assistant Commissioner of Health of the City of Zion.

Engineering Societies

Calendar

Annual Meetings

AMERICAN ASSOCIATION OF ENGINEERS, Chicago, Ill.; Annual Convention, Orlando, Fla., June 2-5, 1925.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, University of Pittsburgh; Annual Meeting, Union College, Schenectady, N. Y., June 17-20, 1925.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Pa.; Annual Meeting, Atlantic City, N. J., June 22-26, 1925.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Summer Meeting, Salt Lake City, July 8-10, 1925.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburg, Fla.; Annual Meeting, Des Moines, Iowa, Oct. 26-29, 1925.

A Joint Meeting of the Virginia Sections of the American Institute of Electrical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, and the American Association of Engineers, was held at the Virginia Military Institute, Lexington, Va., May 8 and 9. The principal speakers were: T. T. Towles, assistant director of public works, Richmond, Va., F. P. Turner, bridge engineer, N. & W. Ry., Roanoke, Va., F. A. Barnes, of Cornell University, C. M. Spofford, of Massachusetts Institute of Technology and Robert Ridgway, president, Am.Soc.C.E.

Personal Notes

GEORGE JEROME, city engineer, Detroit, Mich., has tendered his resignation to take effect June 1; he has served since his appointment in 1923. Mr. Jerome has been engineer for a number of municipalities in the Detroit district including River Rouge, Wyandotte, Springwells, Grosse Pointe, Hamtramck, Highland Park and Ecorse. He is engineer for Ferndale and was also recently appointed engineer for Melvindale.

IN THE DEPARTMENT OF WATER SUPPLY OF THE CITY OF DETROIT the following men have been added to the staff, in order to develop plans and construct Detroit's proposed additional water supply costing in the beginning $25,000,000: WILLIAM C. RUDD, of Cincinnati, Ohio, to be assistant engineer (power); ARTHUR B. MORRELL, formerly principal assistant engineer of the Sanitary District of Indianapolis, to be assistant engineer (filtration); TORRIS EIDE, formerly senior section engineer on construction, New York City Board of Water Supply, and LAURENCE G. LENHARDT, formerly city engineer, Pontiac, Mich., to be assistant engineers (intake, river and land tunnels); FRANK E. SIMPSON, formerly structural engineer, National Analine & Chemical Co., Inc., Buffalo, N. Y., to be design engineer (structure); EUGENE A. HARDIN, formerly designing engineer, hydraulic structures, Black & Veatch, Kansas City, Mo., and JAMES W. ORTON, formerly field resident and designing engineer, Black & Veatch, Kansas City, to be design engineers (filters); JOHN HARDY, formerly assistant engineer, Department of Water Supply, Detroit, to be field engineer. GEORGE H. FENKELL is superintendent and general manager of the Department of Water Supply, Detroit, Mich.

WALTER J. KACKLEY and W. E. REYNOLDS, consulting engineers, formerly of Atlanta, Ga., and CHARLES W. LUSK, consulting engineer, Kansas City, Mo., announce their association for the practice of engineering under the name of Kackley, Reynolds & Lusk, with offices at 123 N. E. Third Ave., Miami, Fla.; they will devote attention to the design and supervision of civil engineering works, particularly bridges and other steel and reinforced-concrete structures, water supply, sewerage, sewage disposal and other municipal improvements, river and harbor work and drainage improvements.

W. F. BARRETT received the honorary degree of Doctor of Science from the University of Pittsburgh at its recent Charter Day exercises, in recognition of his achievements in the production and commercialization of industrial gases. Mr. Barrett has been an important factor in directing the development of the oxyacetylene process and in developing the use of helium. After graduation from Sheffield Scientific School, Yale University, Mr. Barrett served ten years with the People's Gas Light & Coke Co., Chicago, working his way up to the position of assistant general superintendent and assistant chief engineer. In 1913 he became works manager and chief engineer of the Linde Air Products Co., of which he is now vice-president and director. During the War Mr. Barrett served on special government committees on gases for all purposes, offensive and defensive; an important service was the design, construction and operation of the first plant producing helium.

J. C. MANLEY has been reappointed city engineer of Tacoma, Wash., from which position he resigned about a year and a half ago on account of ill health.

W. M. OLSON, formerly junior sanitary engineer with the Chicago Department of Health, has been appointed sanitary engineer to the Cook County Department of Health.

M. R. SCHARFF, valuation engineer of the Philadelphia Co. for the past four years, has been appointed chief engineer of that organization and in that position will have charge of the engineering work of certain public utilities in Pittsburgh, including the Duquesne Light Co., the Equitable Gas Co. and the Pittsburgh Railways Co. Mr. Scharff, who is a native of Mississippi and a graduate of Massachusetts Institute of Technology, was for some years associated with Morris Knowles, of Pittsburgh, as assistant engineer, and then as assistant chief engineer of Morris Knowles, Inc. He has been connected with the Philadelphia Co. since 1921.

O. L. HOEBEL, consulting engineer, Pueblo, Colo., has accepted a position with the Chicago & North Western R.R. as bridge designer, Chicago, Ill. Mr. Hoebel was formerly connected with the railway department of the Morgan Engineering Co. in charge of flood conservancy work in Pueblo; subsequently he was a consulting engineer on railroad work at Pueblo.

PROF. RAYMOND R. MARSDEN has been elected dean of the Thayer School of Civil Engineering at Dartmouth College, succeeding Prof. C. A. Holden, whose resignation was recently announced.

W. J. CONNELL has been appointed city engineer for the city of Menomonee Falls, Wis.

C. H. KIRCH has been appointed bridge engineer of the Wisconsin Highway Commission to succeed W. C. BUETOW, resigned.

Obituary

AUGUST KRUESI, formerly chief construction engineer for the General Electric Co. in Schenectady, died May 7 in El Paso, Texas. Mr. Kruesi was a graduate of Union College, and son of the late John Kruesi who went to Schenectady with Thomas A. Edison to establish the plant that has since become the General Electric Works.

WILLIAM J. STEWART, chief Dominion hydrographer, died at Ottawa, Canada, May 5, at the age of 62 years. In addition to this office, Mr. Stewart was advisory engineer to the International Boundary Commission and represented Canada in establishing the boundary between Canada and the United States as determined by the treaty with Great Britain in 1909; this commission was later merged with the Joint High Commission, with which he was also connected. Since 1912 he had served on various commissions and as consultant for the Canadian government on waterways questions concerning the Great Lakes and St. Lawrence River.

MILO R. BUMP, of Montclair, N. J., chief engineer of Henry L. Doherty & Co., died May 5 in Denver, Colo., of heart disease; he was 44 years of age. Mr. Bump was born in Wisconsin and graduated in electrical engineering from the University of Wisconsin; after spending five years with other companies he became in 1907 examining engineer with the Doherty firm. In 1910 he was made chief engineer, in charge of all engineering work and of the construction and operation departments of the public utility division. He was a past president of the National Electric Light Association, and for four years previous to his presidency had been vice-president.

From the Manufacturer's Point of View

A Point of Contact
Between Maker and User of
Construction Equipment and Materials

Motor Vehicle and Highway Trends in 1924

Registration Higher—Road Maintenance Costs Increase—More of Motor Taxes Used for Roads

The annual report, for the year 1924, of the National Automobile Chamber of Commerce, "Facts and Figures of the Automobile Industry," contains some figures of interest to engineers generally, and more specifically to those concerned with highway construction and maintenance, and the manufacture of equipment and materials.

PRODUCTION DECREASES—REGISTRATION INCREASES

The figures in Table I show that although production of both cars and trucks was smaller in 1924 than in 1923, still their registration increased indicating that 1923 production was probably not altogether absorbed by sales and that part was carried over into 1924.

TABLE I—PRODUCTION AND REGISTRATION

	Prod., 1924	Per Cent Decrease from 1923	Reg., 1924	Per Cent Increase Over 1923
Cars	3,243,285†	12.4	15,460,649	14.7
Trucks	374,317†	4.7	2,131,332	32.1
Total	3,617,602†	11.5	17,591,981	16.5

† Includes Canadian Production of American companies which represents, however, only 3.6%.

Registration, after all, is the factor that is directly related to road building and maintenance. Especially is the increase in truck registration significant to the maintenance divisions of highway departments. However, an analysis of truck production by capacities shows that by far the greater amount of the increase is made up of 1-ton trucks. This class of trucks includes to a great extent Ford trucks and Ford cars, with trucking and delivery bodies. The percentages for 1919 and 1924 given in Table II roughly approximate the trend of production between these years.

TABLE II—TRUCK PRODUCTION BY CAPACITIES

Capacity Tons	1919 Per Cent of Total	1924 Per Cent of Total	1924 No. Trucks
½	21.0	10.8	40,324
1	47.0	71.4	267,790
1½	8.5	7.7	28,946
2	10.0	2.2	8,118
2½	5.5	3.8	14,105
3½	3.8	1.0	3,526
5	2.9	1.8	6,548
Over 5	1.3	1.3	4,960
	100.0	100.0	374,317

Other developments are the use of trucks and buses by the railroads, and the formation of more bus transportation companies. Thirty-three railroads were using trucks on Jan. 1, 1925, to supplement their freight service. In addition to this, the Boston & Maine is planning to substitute buses for some of its passenger train service. There were 60,000 motor buses in the United States on Jan. 1, 1925.

HIGHWAY STATISTICS

There was in the United States, as of January 1925, 2,866,061 miles of highway of which 470,000 miles was surfaced, 40,000 miles being the estimated addition of surfaced roads in 1924. The Federal Aid approved system contains 174,350 miles or 6.1 per cent of the total highway mileage. There are 37,117 miles or 21.2 per cent of the approved system completed and paid for. In addition to this, 17,837 miles or 10.2 per cent of the approved system was under construction on Dec. 31, 1924. The total cost of all Federal Aid projects up to January, 1925 was $632,487,440 of which the Federal government has paid 43.5 per cent. No cost per mile figure is available since this total cost includes all projects either completed or under construction.

The mileage completed of each type of road surface in the Federal Aid approved system is given in Table III. These figures include 4,550 miles of completed highway that have not yet been paid for.

TABLE III—TYPES OF ROAD SURFACE COMPLETED IN FEDERAL AID SYSTEM

	Total Dec., 1924
Graded and drained	8,512.9
Sand clay	4,177.4
Gravel	15,868.4
Waterbound macadam	937.5
Bituminous macadam	2,125.1
Bituminous concrete	1,152.0
Portland cement concrete	8,202.2
Brick	622.7
Bridges and approaches	69.6
	41,667.8

FINANCING THE HIGHWAYS

As shown by Table IV motor vehicle taxes, comprising registration fees, federal excise taxes, and gasoline taxes are, each succeeding year, paying for a greater part of the highway construction and maintenance, the ratio in 1924 being 44.8 per cent. The remaining 55 per cent of the funds spent in 1924 was provided by bonds, property taxes, federal aid, and miscellaneous sources.

TABLE IV—RELATION OF MOTOR VEHICLE TAXES TO HIGHWAY EXPENDITURES

,000—omitted

	Registration Fees	Federal Excise Taxes	Gasoline Taxes	Total Motor Taxes	Highway Expenditures
1921	$122,500	$117,300	$5,300	$245,100	$947,307
Per cent of highway expenditure	13.0	12.4	0.56	25.9	
1922	152,000	114,800	12,000	278,800	898,352
Per cent of highway expenditure	16.9	12.7	1.3	31.0	
1923	189,000	155,800	36,800	381,600	943,339
Per cent of highway expenditure	20.1	16.5	3.9	40.5	
1924	225,492	139,202	79,734	444,428	990,684
Per cent of highway expenditure	22.7	14.0	8.0	44.8	

MAINTENANCE CHARGES HIGHER

A comparison of the Bureau of Public Roads estimates, of expenditures under supervision of the state highway departments, for construction and maintenance during 1924 and 1925, shows that even though the same amount be spent for construction in both years ($403,000,000), maintenance expenditures were estimated at $108,000,000 for 1924, and $135,000,000 for 1925. This increased expenditure for maintenance is, of course, due to the additional miles of highway now in service. This figure can be expected to increase from year to year as new highways are built and more of the present ones reach the repair stage.

Concrete Road Yardage

For April the yardages included in concrete pavement contract awards were, according to reports to the Portland Cement Association: 12,462,646 for roads; 4,431,220 for streets and 469,117 for alleys; or a total for the month of 17,362,983 sq.yd.

The accompanying table summarizes the statistics available to date.

SQUARE YARDS OF CONCRETE PAVEMENT AWARDED DURING 1925

Month	Roads	Streets	Alleys	Total All Classes
January	3,474,421	963,256	75,236	4,512,913
February	3,787,192	1,201,224	58,723	5,047,139
March	5,728,862	2,483,662	190,553	8,403,077
April	12,462,646	4,431,220	469,117	17,362,983
Total	25,453,121	9,079,362	793,629	35,326,112

Grade Marks and Trade Marks to Be Put on Each Piece of Lumber

The subscriber mills of the Southern Pine Association put into effect, April 1, a practice of grade-marking and trade-marking all the lumber and timber that they produce. The marks will consist of a number within a circle, which refers to the mill producing the lumber, the letters "SPA" which form the official symbol of the association, and the grade of the piece; for example: "B & BTR" for B and Better, or No. 1 Com. for No. 1 Common, etc.

This form of marking is considered equivalent to certifying and guaranteeing the quality of the product because the grade brand is backed by the association's official mill inspection service. It is particularly difficult for anyone but an expert to judge the quality of lumber and for this reason authoritative marks should protect both the consumer and the distributor. Grade marking should permit lumber to be sold by grade thus eliminating the necessity for the buyer to inspect each piece. Secretary Hoover says that "in the execution of the program for standardization of lumber sizes and grades, grade-marking practices will be of primary importance."

Waste Prevention Contest Closes

The contest initiated by the National Lumber Manufacturers Association, in which ideas were to be submitted for the prevention of waste in the lumber industry, was terminated by the award of two prizes. The remaining entries were not considered for prizes, for although they generally had merit most of them lacked originality or broad scope of application.

D. F. Denham, Laurel, Miss., was awarded the first prize of $1,000 for a suggestion of a "gang guide" which is claimed to reduce the amount of short and crooked lumber coming from gang sawed logs. Edward McCluskey, Cloquet, Minn., was awarded the second prize of $500 for a log setting retarder whose purpose is to eliminate the tendency of steam set works to over-set resulting in imperfect manufacture.

The committee that made the awards feels that the contest brought out the fact that the industry is not generally making use of meritorious and comparatively inexpensive devices which have long been recognized in practice in some places.

Business Notes

FRANCIS HODGKINSON, chief engineer of the South Philadelphia works of the Westinghouse Electric & Mfg. Co., has left for Japan where he will consult with Japanese engineers on the steam generation of electric power. A law has been passed in Japan providing that all hydro-electric plants hereafter must generate at least 10 per cent of their power output by the use of steam. Another feature of Mr. Hodgkinson's trip is the fact that he will act as a formal messenger of the American Society of Mechanical Engineers, the president of which, Dr. W. F. Durand, has prepared messages of greeting and good will to the three big engineering bodies of Japan.

LINDE AIR PRODUCTS CO., New York, announces the opening of the following district sales offices: 716 First National Soo Line Bldg., Minneapolis, Minn., C. E. Donegon, Mgr.; 409 Lincoln Life Bldg., Birmingham, Ala., W. A. K. Hopp, Mgr.; 508 Exchange National Bank, Tulsa, Okla., G. D. Grubb, Mgr. These offices will handle the sales of oxygen and Prest-O-Lite dissolved acetylene and the extension of service to Linde oxygen customers in their respective territories. Announcement is also made of the appointment of J. W. Foster as district sales manager at Baltimore.

JOE S. BOGGS, formerly State Highway Engineer of Kentucky, is now associated with the Crown Rock Asphalt Co., Cincinnati, as sales manager.

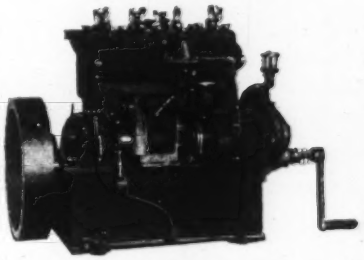
DEAN HILL PUMP CO., Anderson, Indiana, has recently opened a New York office at 149 Broadway which will take care of the sales and service of its products in the metropolitan district.

A. P. COBB, vice-president of the New Jersey Zinc Co., New York City, was elected president of the American Zinc Institute at the annual meeting in St. Louis recently.

Equipment and Materials

New Industrial Engine

A four cylinder engine has been designed by the Universal Motor Co., Oshkosh, Wis., to meet the demands for

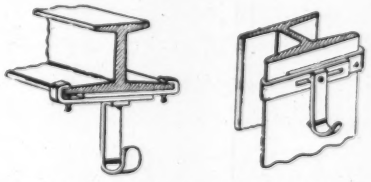


a comparatively small industrial engine. It develops from 5 to 10 hp. on a working range of 650 r.p.m. to 1,200 r.p.m. and is claimed to maintain a practically constant torque. It is equipped with a self oiling governor and Bosch high tension magneto. Base dimensions, shapes, and radiator mountings can be changed to make this unit adaptable for concrete mixers, finishing machines, centrifugal pumps, hoists, and other machines requiring not over 10 hp.

Pipe Hanger Fits Horizontal and Vertical Beams

George Popps, of Massena, N. Y., has recently filed application for a patent on a pipe and cable hanger that is adjustable to the flanges of wall and overhead I-beams of varying widths. This adjustment is made possible by two sliding jaws that may be moved back and forth as desired.

The hanger may be used by contractors who construct temporary pipe



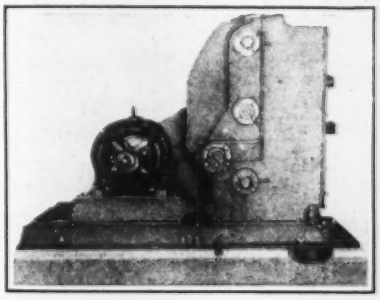
lines, as it can be moved without difficulty and can be taken down and used elsewhere. A hanger that will fit 8-, 10- or 12-in. beams weights about 5 lb.

Double-Stroke, Deep-Well Pump

A. D. Cook, Inc., Lawrenceburg, Ind., has developed a new type of double-stroke, deep well pump head which incorporates this company's forty-five years' experience in manufacturing pumps of this character.

The movement of the two crossheads, two lines of pump rods and two plungers is produced by two bell cranks with their fulcrum bearings mounted in the frame, the bell cranks being opposed so that their motion is opposite. One arm of each bell crank is connected to a different pair of crosshead rods, and in the other arms are slides in which work slide boxes mounted on a common crank pin connecting the two main gears of the pump. By what is known as the old Schaper movement, each plunger is made to make its down stroke when it is going down empty in less time than the up stroke when it is carrying its load, so that for a short time twice in the revolution of the pump both plungers are ascending at the same time, producing an overlap, which prevents the water column from coming to a dead stop at the end of each stroke and eliminates the strain, shock, vibration, valve hammer and gear noise of other types without an overlap.

The pump base contains an oil reservoir from which the oil is pumped by a small gear pump into a tilting pan on the upper bell crank, from which all moving parts of the pump are flooded with oil, eliminating much of the metallic noise of the gears and decreasing wear to a marked degree. The pump frame itself acts as an oil-retaining casing. The unit is mounted upon a rigid pump base, assembled complete in the factory, and very simple of installa-



tion, no pump pit with its many disadvantages being required. The pump head is double geared, the load being distributed equally on each side of the well so that there is no uneven wear in any part of the pump.

Improved Features on New 3-Ton Motor Truck

A 3-ton capacity motor truck with improved features has been placed on the market by the Republic Motor Truck Co., Inc., Alma, Mich. Among the features of this new model are a newly designed radiator with an increased frontal area of 60 sq.in., a clear-vision cab and a driver's seat divided so that the gasoline tank can be filled without removing the seat, since the spout extends up between the two sets of cushions. To add to the strength of the chassis the depth of the frame has been increased and springs have been made heavier, longer and wider. The steering gear has been designed with a screw ratio to afford easy steering and is equipped with ample bearing surfaces. The service brake is mounted on the front propeller shaft at the center bearing support. It consists of a single laminated drum with two wide shoes mounted on a

tubular member especially designed for frequent application without excessive wear or overheating. All working parts of the motor are lubricated by pressure feed. The standard wheel base of the new model is 165 in., with alternatives of 156 and 185 in. available.

British Crawler Tractors Operated by Steam

London Correspondence

Due chiefly to the high price of gasoline and other internal combustion engine fuels the steam wagon has an ever increasing vogue in Britain, burning as it does cheap fuels such as low-grade coal and coke. Trucks with steam engines either above the chassis (overtype), or under the chassis (undertype), are now standardized for municipal and general industrial carriage and haulage. The latest development in the steam truck is the "roadless" or crawler tractor employing an engine located on top of the chassis.

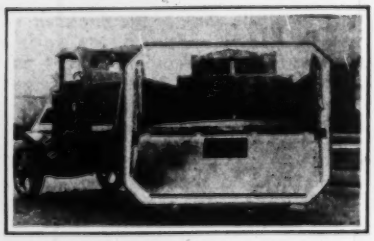
The boiler on this truck consists of a

cylindrical outer shell and a nearly cylindrical inner shell or firebox, the two being connected by annular faced joints at top and bottom to permit the withdrawal of the firebox. Spirally disposed tubes pass across the firebox. This boiler, burning coal, will evaporate 1,800 lb. of water per hour, the working pressure being 230 lb. per square inch. Steam is superheated to 150 deg. F. above saturation temperature.

The engine has two horizontal high pressure cylinders 6¾ in. in diameter by 9 in. stroke. Power is transmitted to the tracks by silent roller chains. The tractor is what is known as the half-track type, the front wheels being retained for steering. The entire weight of the tractor is carried on rubber tires, and the driving sprockets and track-carrying idlers are also shod with rubber.

Steel Motor Truck Body With Renewable Floor

Placement of an independent layer of heavy creosoted planking on top of the steel floor and covering the planking with steel plate is a design followed by the International Motor Co., New York City, in the construction of its steel motor truck body with a renewable floor. Planking is placed on the floor, the steel plate laid upon that and the whole is bound together by a series of flat-headed countersunk bolts. This construction makes it possible to renew the floor simply by removing the fastenings and bolting down a new combination.



With this more or less resilient construction wear and tear on truck bodies through impact in loading from excavations, quarries, etc., where heavy material is handled, is reduced to the minimum.

Publications from the Construction Industry

Road Building — AMERICAN VIBROLITHIC CORPORATION, Des Moines, Iowa, has issued a new edition of its booklet "A Moving Picture of Vibrolithic Concrete Construction," the first edition having been exhausted. It shows how Sheridan Road, Chicago, was built by this method, which consists of vibrating the plastic mass of concrete pavement into compact slabs. Some new illustrations are included in this edition.

Furnace Pipe and Fittings — MILWAUKEE CORRUGATING CO., Milwaukee, Wis., has just issued Catalog 25, a 56-p. reference book on Milcor single and double furnace wall pipe, round pipe and fittings for cold or warm air, furnace accessories, registers and faces, uniform blue stovepipe and corrugated and adjustable stovepipe elbows. Included are diagrams of twenty-four typical problems, standard code for warm-air furnaces in residences and other data on warm-air heating.

Road Machinery — AUSTIN-WESTERN ROAD MACHINERY CO., Chicago, has issued a new 32-p. catalog on the "Austin Pup," a road maintainer and roller, which depicts the adaptability of this equipment for maintaining earth, gravel and similar road surfaces and for leveling and rolling the subgrade for concrete and other hard surfacing. Emphasis is placed on a new attachment for scarifying the old surface.

Centrifugal Pumps—EMERSON PUMP & VALVE CO., INC., Alexandria, Va., has issued a 12-p. bulletin bringing up to date the data on its single- and two-stage centrifugal pumps. The bulletin gives lists of sizes and capacities, and speed tables for pumps operated at low and high pressures.

Motor Transportation — THE WHITE CO., Cleveland, commemorates "a quarter century of White transportation" in a special edition of the company's publication, *The Albatross*. It shows in type and pictures the development of the White truck, from the first one, built in 1900, to the advanced models of 1925. The work of the White Co. in the good roads movement is emphasized and the story is told of how White path-finding cars were out to chart the roads, and of how this work was followed by the publication of route books. Now, it is stated, more than 5,000 White trucks are engaged in the work of building and maintaining roads.

Heating — AMERICAN BLOWER CO., Detroit, Mich., has issued a folder deprecating the expenditure yearly of millions of dollars for piping steam for heating purposes to radiators in buildings where steam is not otherwise required. It advocates the use of American Blower direct fired heaters, burning coal, coke, gas or wood, for the heating of such buildings as garages, foundries, warehouses, stock sheds, woodworking plants, and machine shops where the machines are electrically driven.

Power Shovels — THEW SHOVEL CO., Lorain, Ohio, in a 20-p. booklet, presents details of the design and construction of the new center drive feature of the crawler mounting for its power shovels.

Road Building — GOOD ROADS MACHINERY CO., INC., Kennett Square, Pa., in a 10-p. pamphlet describes its Monarch Cub roller. The power plant of this roller is a Fordson tractor and it is made in 4-ton and 5-ton sizes. It is claimed that this roller, because of its low initial cost, convenience of operation, and small upkeep cost, will appeal to the road official or contractor who does only a small amount of work as well as to those who carry on large operations.

Testing Machines — RIEHLE BROS. TESTING MACHINE CO., Philadelphia, is distributing a 12-p. booklet on U. S. standard vertical screw power testing machines. It emphasizes the importance to a concern of testing intelligently all the materials entering into the construction of its products and determining also by this means where economy can be practiced in the designs of its machines.

Road-Building Equipment — BLAW-KNOX CO., Pittsburgh, Pa., has published a 28-p. booklet on the various lines of roadbuilding equipment marketed by this company. These include road forms, batchers, buckets and forms for concrete curb and sidewalk construction.

Power Transmission Machinery—W. A. JONES FOUNDRY & MACHINE CO., Chicago, has distributed its new General Catalog 30. It contains 448 pages of power transmission data, including data on cut gears, cast gears, spur gear speed reducers, inclosed worm gear drives, cast-iron pulleys, friction clutches, sprocket wheels, hangers, pillow blocks, couplings, rope sheaves, etc.

Bucket Elevators—JEFFREY MFG. CO., Columbus, Ohio, has issued a new catalog featuring its complete line of standardized bucket elevators for service in sand and gravel plants, quarries, cement mills, industrial plants, coal yards, power houses, fertilizer plants, railroad coaling stations and other industries where loose material is to be handled.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Business Briefs

Call money quoted at 3¾ per cent, May 18; year ago, 3 per cent.

Time loans for all periods, 3¾@4 per cent.

Foreign exchange, demand:

	Par	This Week	Last Week	Year Ago
Sterling	$4.86⅔	$4.85⅛	$4.84⅛	$4.36⅛
Franc	.193	.0519	.0521¼	.0547⅛
Lira	.193	.0405½	.0410⅛	.0443¾
Mark	.238	.2381	.2381	.....

Public Bond Sales Slower in April

April bond sales totaled $92,664,263 according to *The Commercial and Financial Chronicle*. This is $18,000,000 below the March awards.

The largest issues of the past month were: $4,000,000 4½s, 12 separate issues, Buffalo, N. Y.; $3,750,000 4s, impt. bonds, Philadelphia, Pa.; $3,000,000 4s and 4½s, highway bonds, State of Michigan; $3,000,000 4s, Chicago South Park Dist., Ill.; $3,000,000 5s, school bonds, Los Angeles, Calif.

The rates ranged from 4 to 6 per cent. Awards made at par or below were small in number.

24,000 Mi. of Highways Scheduled for 1925

Activity Greatest In South and West—Current Road Lettings Ahead Of This Time Last Year

The 1925 state highway construction programs will aggregate nearly 6,000 mi. of hard surfacing according to the recent report of the U. S. Bureau of Public Roads. In addition there is scheduled 18,000 mi. of earth, gravel, sand-clay and macadam.

The principal activity is expected in the Western and Southern states.

Comparing the paving contracts (money value) for the first quarter of this year with those of the corresponding period in 1924 shows that most of the gains were in the Middle West and the states immediately west of the Mississippi. Comparison with the last quarter of 1924 shows that the South, the Middle West and the Far West were most active in road building.

These findings are supported by weekly records of street and road contracts reported in *Engineering News-Record* between April 1 and May 14, inclusive, which show a gain of 11 per cent over the corresponding period last year. The following table shows that while first quarter lettings were 11 per

(Continued on p. 876)

This Week's Contracts—Week Ago—Same Week Last Year

The money value of contracts reported in the present issue of *Engineering News-Record* is here compared with the figures for corresponding weeks.

Minimum costs observed are: $15,000 for waterworks and excavations, $25,000 for other public works, $40,000 for industrial and $150,000 for commercial buildings.

MONEY VALUE OF CONTRACTS LET—ENTIRE U. S.

Week Ending	Public Work	Private Work	Total Contracts
May 21, 1925	**$22,754,000**	**$12,298,000**	**$35,052,000**
May 14, 1925	21,866,000	42,744,000	64,610,000
May 22, 1924	35,046,000	13,689,000	48,735,000
Heaviest Week			
1924, May 8	26,370,000	38,829,000	65,199,000
1925, Apr. 2	43,603,000	27,633,000	71,236,000
Jan. 1 to Date			
1925	380,906,000	509,817,000	890,723,000
1924	383,417,000	462,131,000	845,548,000

REPRESENTATIVE PUBLIC BOND SALES, APRIL, 1925

State	Purpose	Amount	Rate per Cent	Sold For	Basis	Dated	Maturity	Purchased by
Michigan	Highway	$3,000,000	4½		4.0463			
			4½	100.009	4.06	May 1	1940	Keane, Taylor & Co.
County								
Benton, Ind.	Road	12,000	4½	101.44	4.20	April 15		
		22,400	4½	101.29	4.24	April 20	1926-35	J. F. Wild & Co.
Brown, Kan.	Road	14,395	4½	100	4½	Jan. 14		Morrill & James Bank
Buchanan, Va.	Road and Bridge	150,000	5½	100.38	5.43	April 1	1955	Walter, Woody & Heimerdinger
Calhoun, Fla.	Road	30,000	6	107.60	4.36	Jan. 1	1930-59	G. B. Sawyers Co.
Cherokee, N. C.	Road and Bridge	200,000	4½	100.55	...	April 1	1955	Stranahan, Harris & Oatis
Columbia, N. Y.	Highway	42,000	4½	100.89	4.30	Mar. 1	1945-48	A. E. Aub & Co.
	County home	25,000						
Crawford, Ind.	Road	14,264	5	103.51	4.28	Mar. 2	1926-35	Fletcher American Co.
Cuyahoga, O.	Road	343,421	5	103.32	4.32	May 1	1926-35	Tillotson, Wolcott & Steele
Daviess, Ind.	Highway	93,480	4½	102.33	...	April 15		City Securities Corp.
Dyer, Tenn.	Road	1,000,000	4½	.....	.....	April 1	1955	I. B. Tigrett & Co. and others
Dade, Fla.	Bridge	300,000	5	105.46	4.66	Oct. 1	1930-74	Geo. H. Burr & Co., and others
	Highway	570,000						
Erie, Pa.	Road	430,000	4½	103.727	4.03	April 1	1931-41	Mellon National Bank
Franklin, O.	Sewers	65,800	5	103.05	4.34	April 1	1926-35	The Detroit Trust Co.
	Sewers	117,800	5	101.93-103.10	4.61-4.38	Oct. 1	1926-35	The Provident Savings Bank & Trust Co.
Greene, Ind.	Road	32,000	5	103.56	4.33	Feb. 15	1926-35	First National Bank of Linton
Hudson, N. J.	Building	2,500,000	4½	103.37	4.20	April 15	1927-54	First National Bank of N. Y. C. and others
Henry, O.	Road	185,000	5	103.06	4.35	April 15	1926-35	The Herrick Co. of Cleveland
Kenosha, Wis.	Highway	360,000	4½	102.08	4.24	April 1	1926-45	Illinois Merchants Trust Co. and others
Lucas, O.	Highway	71,282	5	102.29	4.17	April 15	1926-29	A. T. Bell & Co. of Toledo
Township								
Jackson, N. C.	Road	10,000	6	100.31	5.95	May 1	1926-45	Provident Savings Bank & Trust Co. of Cincin
Sheldon, S. C.	Road	50,000	6	100.00	6	May 1	1926-50	Spitzer, Rorick & Co. of Toledo
Municipal								
Altamont, N. Y.	Water	14,000	4½	102.386	4.29	July 1	1927-54	Fidelity Trust Co. of Buffalo
Alhambra, Calif.	Water	70,000	5	108.07	4.50	Aug. 1	1949-58	E. H. Rollins & Sons of Los Angeles
Atlanta, Ga.	Street Impvt.	79,000	4½	101.48	...	April 1	1927-34	Trust Co. of Georgia, Atlanta
Apex, N. C.	Water and Sewer	135,000	5½	100.76	5.20	April 1	1928-65	The White-Phillips Co. of Davenport
Attica, N. Y.	Water	69,000	4½	102.58	4.26	May 1	1926-54	The Fidelity Trust Co. of Buffalo
Buffalo, N. Y.	Buildings Impvt.	4,000,000	4½	102.565	3.93	May 1	1926-45	First National Bank of N. Y. C. and others
Birmingham, Mich.	Sewer	30,000	5	105.72	4.32	Oct. 1	1929-44	The Detroit Co.
Bellingham, Wash.	Water	265,000	5	100.53	...	April 1	1928-45	Blyth, Witter & Co.
Canton, O.	Paving and St. Impvt.	254,558	5	112.03	4.17	Dec. 1	1927-50	Blanchett, Thornburgh & Bowman
Chattanooga, Tenn.	Impvt.	855,000	4½	106.19	4.39	April 1	1955	Caldwell & Co., and others
Duluth, Minn.	Impvt.	2u0,000	4½	102.69	4.16	April 1	1926-45	C. W. McNear & Co. of Chicago
Eugene, Ore.	St. Impvt.	13,698	5	101.00	...	Feb. 1	1935	Peirce, Fair & Co. of Portland
Ellis, Kan.	City Building	42,000	5	98.50	5.19	July 1	1926-45	Fidelity National Bank of Kansas City
Elkin, N. C.	Water and Light	70,000	5½	101.67	5.11	Mar. 1	1927-61	American Trust Co. of Charleston
Fergus Falls, Minn.	Impvt.	15,000	4½	103.10	4.43	Mar. 2	1928-42	Fergus Falls Clearing House Assoc.
Glendale, Calif.	Sewer	300,000	5	104.45	4.67	Mar. 1	1926-63	R. H. Moulton & Co. of San Francisco
Grand Rapids, Mich.	St., Water and Sewer	1,007,000	4½	100.72	4.15	April 1	1945	Eldredge & Co. of New York
Gloucester, Mass.	Water	20,000	4	100.58	....	April 1	1926-46	Gloucester Safe Deposit & Trust Co.
Harrisburg, Tex.	Impvt.	250,000	6	104.80	...	Mar. 25	1926-65	Blanton & Co., of Houston
Haines City, Fla.	St. Impvt.	30,000	6	103.40	5.25	April 1	1926-35	State Bank of Haines City
Omaha, Neb.	St. Impvt.	800,000	4@4½	100.07	4.152	May 1	1945	The Detroit Co. of Detroit and others
Philadelphia, Pa.	Impvt.	3,750,000	4	101.597	3.86	April 16	1940	Sinking Fund Comm.
Plymouth, Mich.	Fire and Water	50,000	4½	101.24	....	.....	.....	Whittlesey, McLean & Co. of Detroit
Riverdale, N. J.	Water	22,000	5	.....	.....	April 1	1926-47	New Jersey & Plate Glass Ins. Co.
Struthers, O.	St. Impvt.	19,641	6	103.62	4.84	May 1	1926-30	Herrick Co. of Cleveland

Weekly Construction Market

THE trend of construction cost is downward but the descent is being accomplished by easy stages. Basic materials are plentiful enough at mills and in dealers' warehouses to prevent a sudden price advance.

All materials are moving in larger volume than a year ago. Despite this fact, such items as sand, gravel, crushed stone and other aggregates are cheaper than a year ago in all parts of the country except the South and West.

Steel shapes are $2 per 100 lb., Pittsburgh, against $2.10 to $2.35, in May, 1924. Brick is in good demand and with prices firmer in the New York district as consumption gets nearer to the rate of production. Tile is also firmer with no notable advances since April 1. Lime, while it follows closely the brick demand, is not so definite as to price trend; advances in one quarter being offset by declines in another part of the country.

Cement prices are notably stable. Unprecedented quantities are being stored at mills to meet the stiff rise in demand started in February and scheduled to reach its peak in October.

Lumber demand is active for pine timbers, flooring (upper grades), dimension lumber, boards, lath and railroad cutting. Scarcity is reported, with prices firmer for timbers, car decking and sills. Telegraphic reports to *E. N.-R.* state that Northwestern fir lumber camps will shut down for the season in advance of regular schedule and will not reopen until the log market shows greater stability.

Window glass (10x12 in.) and gypsum plaster are advancing while roofing materials, particularly composition shingles, are slightly lower as to price.

	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Steel Products									
Structural shapes, 100 lb	$3.34	$3.90	$4.15	$3.10	$3.35	$3.07½	$3.30	$3.35	$4.25
Structural rivets, 100 lb	4.50	4.45	4.75	3.50	3.75	4.65	5.00	3.75	6.00
Reinforcing bars, ¾ in. up, 100 lb	3.24	3.40	3.38	3.00	3.25	3.87½	3.35	3.25	2.30
Steel pipe, black, 3½ to 6 in. lap, discount	48%	53.2%	43%	57%	54.25%	36%	40.6@52.1%	50%	59.49
Cast-iron pipe, 6 in. and over, ton	50.60@51.60	56.00	56.00	46.70@48.20	53.00	62.00	55.00	55.00	60.00
Concreting Material									
Cement without bags, bbl	2.50@2.60	2.30	2.05	2.20	2.42	2.84	2.31	2.65	1.80
Gravel, ¾ in., cu.yd	1.75	1.90	2.38	2.75	1.65	1.90	2.15	1.50	1.25
Sand, cu.yd	1.00	1.40	2.00	2.75	1.25	1.00	1.50	1.50	1.25
Crushed stone, ¾ in., cu.yd	1.85	2.00	2.83	2.75	1.75	2.50	2.15	3.00	1.90
Miscellaneous									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft	60.00	35.00	56.00	29.00@39.00	39.75	34.75	27.00	23.00	60.00
Lime, finishing, hydrated, ton	18.20	22.50	20.00	20.00	25.50	24.00	22.00	24.00	21.00
Lime, common, lump, per bbl	2.50@2.75	1.45	1.85	1.21	1.35	2.70	1.60	2.80	9.50
Common brick, delivered, 1,000	+17@19	10.50	12.10	12.00	13.50@13.60	12.00	15.50	15.00	17.50
Hollow building tile, 4x12x12, per block	Not used	.0808	.0941	.06	.07	.085	.....	.10	.12
Hollow partition tile 4x12x12, per block	.1162	.0808	.0941	.06	.....	.085	.108	.10	.10
Linseed oil, raw, 5 bbl. lots, gal	1.09	+1.15	1.30	1.23	1.15	+1.28	—1.14	1.12	1.25
Common Labor									
Common labor, union, hour	.75	.30	.....	.87½	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour	.....	.25	.30@.50	.75	.50@.55	.35@.50	.50	.50	.25@.35

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b. Labor—Concrete laborers' rate, 93¾c.; building laborers, 75c.; excavating laborers, 50c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber, sand, gravel and stone delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.70 for Kelly Island and $1.60 for Sheboygan. Common labor not organized.

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of May 7, the next on June 4.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered in wooden bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Brick and hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand stone, gravel and lump lime per ton. Stone, lime and tile are delivered; sand, gravel and cement on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at par). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3½-in., $59.49.

24,000 Mi. of Highways Scheduled for 1925

(*Concluded from p. 875*)

cent under the same period last year, they were three per cent ahead of the last three months in 1924:

	First Quarter 1925	First Quarter 1924	1925 Difference Per Cent	Last Quarter 1924	1925 Difference Per Cent
New England	$815,000	$2,681,000	—70	$1,724,000	—53
Middle Atlantic	7,984,000	11,599,000	—31	8,769,000	— 9
South	13,381,000	17,552,000	—24	12,926,000	+ 3
Middle West	15,237,000	13,938,000	+ 9	13,102,000	+17
West of Mississippi	21,499,000	18,557,000	+15	22,754,000	— 5
Far West	9,290,000	12,529,000	—26	7,186,000	+29
Total	$68,206,000	$76,856,000	—11	$66,461,000	+ 3